PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-219697

(43)Date of publication of application : 19.08.1997

---

(51)Int.Cl. H04L 1/00

G06F 13/00

H04B 7/26

H04Q 7/38

H04B 17/00

H04L 27/18

---

(21)Application number : 08-024328 (71)Applicant : SHARP CORP

(22)Date of filing : 09.02.1996 (72)Inventor : KUKI TERU

NAKANO TAKAHIKO

---

# (54) RADIO COMMUNICATION EQUIPMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a radio communication equipment which is capable of exactly recognizing the fluctuation of radio line quality, more surely and delicately predicting the possibility of the surcess or failure of data communication and displaying the prediction.

SOLUTION: Based on the information obtained in an electric field intensity measuring part 102, a digital signal modulation/demodulation processing part 103 and a channel processing part 104, etc., a line quality measuring part 106 determines the line quality for every prescribed time and stores it in time series in a line quality storage part 107. At the time of the success/failure of the connection processing with an opposite party and at the time of the failure of a data transfer, etc., a data communication quality learning part 109 extracts a

feature from line quality stored so far and reflects it on learning. A data communication quality predicting part 108 predicts the possibility of the success/ failure of data communication by comparing the feature of the line quality stored at a point of time before the execution of the data communication and the learning and displays the prediction on a display part 110.

---

LEGAL STATUS [Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] A measurement means to measure wireless circuit quality in the radio communication equipment which performs data communication using a wireless circuit, A circuit quality storage means to accumulate serially the measured value of the wireless circuit quality acquired by the above-mentioned measurement means, A communication link quality prediction means to predict the quality of data communication based on the measured value of the wireless circuit quality accumulated in the above-mentioned circuit quality storage means from the event of there being the past at a fixed period, The radio communication equipment characterized by having an information means to report to a user the result predicted by the above-mentioned communication link quality prediction

means.

[Claim 2] The radio communication equipment according to claim 1 characterized by to have further an error measurement means measure the error which changes the regular point of the above-mentioned recovery signal into a zero, and produces to a recovery signal by the noise in the two-dimensional space centering on the amplitude direction of a recovery means get over to the recovery signal which has the inphase component and the quadrature component which intersect perpendicularly mutually the subcarrier which received from a wireless circuit, and the above-mentioned inphase component and a quadrature component as a distance from the above-mentioned zero.

[Claim 3] [ when a study value storage means to memorize the study value made into the criteria for predicting the quality of data communication, and the predetermined event about data communication occurred ] While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time The study value which is calculated based on the above-mentioned predetermined event in the past, and has already been memorized by the above-mentioned study value storage means [ when it has a study value decision means to update to the new study value in which the above-mentioned description was made to reflect and the above-mentioned communication link quality prediction means predicts the

quality of data communication ] The radio communication equipment according to claim 1 characterized by predicting the quality of data communication by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing the study value memorized by this description and the above-mentioned study value storage means.

[Claim 4] Termination of connection processing with the partner of data communication is included as the above-mentioned predetermined event. The above-mentioned study value storage means memorizes at least one side of the study value corresponding to each at the time of [ which connection processing terminated normally ] case and terminating abnormally. The above-mentioned study value decision means by searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period before the event of connection processing being completed whenever connection processing was completed, and making this description reflect [ while updating the study value memorized, when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The radio communication equipment according to claim 3 characterized by predicting the situation of connection processing with the partner of data communication by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing this description with the

above-mentioned study value.

[Claim 5] It has further a transfer means to choose either from two or more kinds of transfer rates, and to perform data communication. [ when the above-mentioned study value storage means was equipped with the storage region which memorizes the study value according to each of the transfer rate which can be set up with the above-mentioned transfer means, respectively and the predetermined event concerning / the above-mentioned study value decision means / data communication occurred ] While updating the study value of the storage region according to the transfer rate which searched for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time, and it is at the event and the transfer means has chosen [ above-mentioned ] to the new study value in which the above-mentioned description was made to reflect [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The radio communication equipment according to claim 3 characterized by the above-mentioned transfer means predicting a selectable transfer rate by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing the study value memorized by this description and the above-mentioned study value storage means.

[Claim 6] the time check which measures a duration after starting connection processing until it ends -- with a means A study value storage means to memorize the description of the circuit quality value accumulated in the duration of the connection processing in the past, and a fixed period before this connection processing as a study value, While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time whenever connection processing is completed It has a study value decision means to update to the new study value in which the duration measured with the means was made to reflect. the study value already memorized by the study value storage means -- the above-mentioned description and a time check -- [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The radio communication equipment according to claim 1 characterized by predicting the duration of connection processing as quality of data communication based on the study value which searches for the description of the circuit quality value accumulated in a fixed period of before at that time, and is memorized by this description and the above-mentioned study value storage means.

[Claim 7] the time check which measures a duration after starting data communication until it ends -- with a means A study value storage means to memorize the description of the circuit quality value accumulated in the duration

of the data communication in the past, and a fixed period before this data communication, While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time whenever data communication is completed It has a study value decision means to update to the new study value in which the duration measured with the means was made to reflect. the study value already memorized by the study value storage means -- the above-mentioned description and a time check -- [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The radio communication equipment according to claim 1 characterized by predicting the time amount in which the continuation communication link of data is possible as quality of data communication based on the study value which searches for the description of the circuit quality value accumulated in a fixed period of before at that time, and is memorized by this description and the above-mentioned study value storage means.

[Claim 8] It has a communication link activation means to choose and perform either from two or more kinds of data communication applications. When the above-mentioned study value storage means is equipped with the storage region which memorizes the study value according to each of selectable data communication application with the above-mentioned communication link

activation means and the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurs While updating the study value memorized in the storage region according to the data communication application which the communication link activation means has chosen The radio communication equipment according to claim 3, 6, or 7 characterized by predicting using the study value memorized in the storage region according to the data communication application which the communication link activation means has chosen when the above-mentioned communication link quality prediction means predicts the quality of data communication.

[Claim 9] The above-mentioned study value storage means is equipped with two or more kinds of storage regions which memorize the study value according to the magnitude of commo data. While updating the study value of the storage region corresponding to the magnitude of the commo data at the time of the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurring The radio communication equipment according to claim 3, 6, or 7 characterized by predicting using the study value of the storage region according to the magnitude of commo data when the above-mentioned communication link quality prediction means predicts the quality of data communication.

[Claim 10] The above-mentioned study value storage means is equipped with two or more kinds of storage regions which memorize a study value according to the identifier of the partner of data communication. While updating the study value of the storage region corresponding to the identifier of the communications partner at the time of the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurring The radio communication equipment according to claim 3, 6, or 7 characterized by the above-mentioned communication link quality prediction means predicting using the study value of the storage region according to the identifier of the communications partner at the time of predicting the quality of data communication.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention] this invention -- for example, PHS (Personal Handy-phone System) etc. -- it is applied to the radio communication equipment which performs data communication using the cellular phone which performs a

voice call using a wireless circuit, and is related with the radio communication equipment which has the function which predicts the quality of data communication and is reported to a user in more detail.

[0002]

[Description of the Prior Art] recent years (Personal Handy-phone System), for example, PHS, etc. -- the cellular phone which can perform a voice call using a wireless circuit is put in practical use, and it has spread widely. Moreover, it is possible it not only to perform a voice call, but to perform data communication through a wireless circuit in the above-mentioned conventional cellular phone. As the most general approach of such data communication, a personal computer etc. is connected to a cellular phone through the modem for data communication, a wireless circuit is connected among phase hands by dialing actuation from a cellular phone, and the method of performing data communication through the above-mentioned modem for data communication between the above-mentioned personal computer and a phase hand etc. is used.

[0003] Moreover, the conventional cellular phone is usually equipped with the function which measures and displays the field strength in the current position. Thereby, a user can judge whether it is strong to extent to which the field strength of the current position can telephone, if field strength is inadequate, will move to a suitable location and will perform call origination or the waiting

receptacle for arrival of the mail.

[0004] when actually performing data communication using a cellular phone, it indicates that sufficient field strength for a voice call exists, and actually, although the voice call is possible, the case where it is said that data communication is impossible carries out by being alike occasionally, and exists. That is, the factor of degradation of the communication link quality in a wireless circuit is an element not only with lowering of field strength but important phasing, interference, or noise etc. For this reason, it is impossible to judge to accuracy whether data communication is possible about the quality of a wireless circuit only based on field strength.

[0005] In a voice call, when the quality of a wireless circuit deteriorates, even if the increment in a noise and lowering of voice level occur, until can understand human being to some extent. Moreover, in the signal which digitized especially voice, even if lack or a reception error of some data occurs, it is possible to perform the complement by the predicted value using the frequency characteristics of human being's voice. Moreover, as long as the complement can reach the level which human being can understand, it may not be perfect.

[0006] On the other hand, since, as for the case of data communication, such as a file transfer, bitwise has important semantics, when the increment in a noise and lowering of level occur by degradation of the quality of a wireless circuit,

there is a possibility of inviting a fatal error. Moreover, the complement by the predicted value using the frequency characteristics of human being's voice which were described above is not suitable, and a strict error correction is needed.

[0007] On the other hand, the method of judging the communication link quality of a channel is indicated by JP,5-207544,A from the field strength information and noise information on an input signal for the purpose of predicting the possibility of the success or failure of data communication from elements other than field strength. Moreover, the situation of the error of data which received from the communications partner is detected, and in communicating, the approach of indicating whether be in the optimal situation is indicated by JP,5-61789,A.

[0008]

[Problem(s) to be Solved by the Invention] However, in order to make a more positive thing a judgment whether the data communication through a wireless circuit is possible, it is necessary to solve the still more nearly following technical problems.

[0009] For example, there are some to which the resending function of a frame is added in the conventional common modem for data communication, and when such a modem is used, the possibility of the success or failure of data

communication cannot be judged only from the quality of the data communication of a certain flash to accuracy. With such a configuration, the user needed to communicate, after confirming that observed the display for a while and the condition was stable. However, since it is what it is easy to change according to various factors as compared with a wire circuit as it depends for this on intuition of an individual to the last and the quality of a wireless circuit was mentioned above, positive prediction is impossible.

[0010] Moreover, it is possible for multimedia-ization of communication equipment to progress, to carry communication link application with one various communication device, and to realize various functions, such as not only a voice call function but a FAX function, an electronic mail function, or a file transfer function, in recent years, corresponding to a user's selection. What has a mutually different protocol, and the gestalt of the data been and treated and its amount of data of such communication link applications are various. For this reason, it is impossible like before to show a user the possibility of the success or failure of various data communication certainly simply by the prediction approach only based on the quality of the wireless circuit of a certain flash.

[0011] This invention grasps the fluctuation situation of the quality of a wireless circuit more exactly, and aims at offering a radio communication equipment with a user able to perform data communication in a more suitable situation to the

user by showing the possibility of the success or failure of data communication more certainly and more finely.

[0012]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the radio communication equipment of this invention according to claim 1 A measurement means to measure wireless circuit quality in the radio communication equipment which performs data communication using a wireless circuit, A circuit quality storage means to accumulate serially the measured value of the wireless circuit quality acquired by the above-mentioned measurement means, It is characterized by having a communication link quality prediction means to predict the quality of data communication based on the measured value of the wireless circuit quality accumulated in the above-mentioned circuit quality storage means from the event of there being the past at a fixed period, and an information means to report to a user the result predicted by the above-mentioned communication link quality prediction means.

[0013] According to the configuration according to claim 1, a measurement means measures wireless circuit quality and the measured value is serially memorized by the storage means. In addition, it is desirable to choose a suitable thing as wireless circuit quality to measure according to the property and data communication system of the wireless circuit. Furthermore, a communication link

quality prediction means predicts the quality of data communication based on the measured value of the wireless circuit quality accumulated in the above-mentioned storage means from the event of there being the past at a fixed period, and an information means reports the prediction result to a user. Thereby, a user becomes possible [ taking the measures of postponing activation of data communication ] until it can check the possibility of a success of data communication with an information means, and it moves to the location which can communicate in a situation better when the possibility of a success is low in advance of activation of data communication or a situation is improved. Moreover, since the above-mentioned prediction is what is obtained from the are recording result of the measured value in a predetermined period, it has high dependability as compared with the prediction based on the measured value of only a certain flash. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped exactly, and it becomes possible to offer the radio communication equipment which can predict quality of data communication effectively.

[0014] A radio communication equipment according to claim 2 is set to a radio communication equipment according to claim 1. In the two-dimensional space centering on the amplitude direction of a recovery means to get over to the recovery signal which has the inphase component and quadrature component

which intersect perpendicularly mutually the subcarrier which received from the wireless circuit, and the above-mentioned inphase component and a quadrature component The regular point of the above-mentioned recovery signal is changed into a zero, and it is characterized by having further an error measurement means to measure the error produced to a recovery signal by the noise as a distance from the above-mentioned zero.

[0015] According to the configuration according to claim 2, when it gets over to the recovery signal which has the inphase component and quadrature component a quadrature component and a recovery means cross at right angles mutually the subcarrier which received from the wireless circuit and an error measurement means changes the regular point of the above-mentioned recovery signal into the zero on two-dimensional space, the error produced to a recovery signal by the noise is measured as a distance from the above-mentioned zero. This is enabled to observe only the error by the noise, without spoiling the property of a noise, and it becomes possible to measure the property of a noise easily. For example, it can also judge by which of a phase and the amplitude the noise has done effect strongly also about the noise of the impulse nature generated irregularly. Moreover, an error measurement means becomes possible [ also checking the property of a noise easily by viewing ] by inputting the output of an error measurement means into an oscilloscope etc. in

order to extract only a noise component for the regular point as a zero. Consequently, the situation of a wireless circuit of tending to change circuit quality can be grasped more exactly, and it becomes possible to offer the radio communication equipment which can predict quality of data communication effectively.

[0016] A radio communication equipment according to claim 3 is set to a radio communication equipment according to claim 1. [ when a study value storage means to memorize the study value made into the criteria for predicting the quality of data communication, and the predetermined event about data communication occurred ] While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time The study value which is calculated based on the above-mentioned predetermined event in the past, and has already been memorized by the above-mentioned study value storage means [ when it has a study value decision means to update to the new study value in which the above-mentioned description was made to reflect and the above-mentioned communication link quality prediction means predicts the quality of data communication ] It is characterized by predicting the quality of data communication by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing the study

value memorized by this description and the above-mentioned study value storage means.

[0017] According to the configuration according to claim 3, the study value made into the criteria for predicting the quality of data communication is memorized by the study value storage means. A communication link quality prediction means The description of the circuit quality value accumulated in the circuit quality storage means in a fixed period before the event of predicting quality of data communication is searched for, and quality of data communication is predicted by comparing the description searched for with the study value memorized by the above-mentioned study value storage means. Moreover, the above-mentioned study value is always updated by reflecting the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time, when the predetermined event about data communication, such as failure in wireless line connection processing for example, with a phase hand or failure in data transfer, occurs. That is, when the criteria at the time of predicting quality of data communication are always updated by the study according to a situation, the dependability of prediction of data communication is raised further. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and it becomes possible to offer the radio communication equipment which can ensure

prediction of the quality of data communication.

[0018] A radio communication equipment according to claim 4 is set to a radio communication equipment according to claim 3. Termination of connection processing with the partner of data communication is included as the above-mentioned predetermined event. The above-mentioned study value storage means memorizes at least one side of the study value corresponding to each at the time of [ which connection processing terminated normally ] case and terminating abnormally. The above-mentioned study value decision means by searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period before the event of connection processing being completed whenever connection processing was completed, and making this description reflect [ while updating the study value memorized, when the above-mentioned communication link quality prediction means predicts the quality of data communication ] It is characterized by predicting the situation of connection processing with the partner of data communication by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing this description with the above-mentioned study value.

[0019] With a configuration according to claim 4, whenever connection processing with the partner of data communication is completed, search for the

description of the circuit quality value accumulated in the circuit quality storage means at a fixed period before the termination event, the description is made to reflect, and a study value is updated. Moreover, when this study value is updated in one [ at least ] case at the time of [ which connection processing terminated normally ] case or terminating abnormally and it is updated in the case of above both, the separate study value is established according to each ****. That is, with the above-mentioned configuration, the description of the circuit quality value at the time of termination of connection processing is reflected in the study value according to the situation at the time of termination.

[0020] The 1st step of data communication can be divided roughly into the 2nd step which connects a circuit among phase hands in advance of a data transfer, and generally establishes the condition in which a data transfer is possible and which performs a data transfer actually, and the 3rd step which cancels connection with a phase hand, and the connection processing in claim 4 is equivalent to the 1st above-mentioned step. Since the study value at least according to one side with the case where it terminates abnormally with the case where connection processing terminates normally, with the above-mentioned configuration is memorized Possibility that the connection processing performed from now on will be successful as prediction of the quality of data communication can be more certainly predicted by comparing with the above-mentioned study

value the description extracted from the circuit quality value accumulated when predicting the quality of data communication. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and it becomes possible to offer the radio communication equipment whose soundness of prediction of the quality of data communication improved.

[0021] A radio communication equipment according to claim 5 is set to a radio communication equipment according to claim 3. It has further a transfer means to choose either from two or more kinds of transfer rates, and to perform data communication. [ when the above-mentioned study value storage means was equipped with the storage region which memorizes the study value according to each of the transfer rate which can be set up with the above-mentioned transfer means, respectively and the predetermined event concerning / the above-mentioned study value decision means / data communication occurred ] While updating the study value of the storage region according to the transfer rate which searched for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time, and it is at the event and the transfer means has chosen [ above-mentioned ] to the new study value in which the above-mentioned description was made to reflect [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The above-mentioned transfer

means is characterized by predicting a selectable transfer rate by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing the study value memorized by this description and the above-mentioned study value storage means.

[0022] According to the configuration according to claim 5, the description value calculated when the predetermined event about data communication occurs is reflected in the study value memorized in the storage region according to the transfer rate chosen with the transfer means at the event. That is, the study value used with the above-mentioned configuration is a study value according to each of a selectable transfer rate with the transfer means. Furthermore, a communication link quality prediction means reports to a user the result the above-mentioned transfer means predicted and predicted the selectable transfer rate to be by comparing the description extracted from the circuit quality value accumulated at the event when predicting the quality of data communication with the study value memorized by the above-mentioned study value storage means.

[0023] Since it is the value always updated by reflecting the description in which the study value used as the criteria which choose the above-mentioned transfer rate is extracted from the circuit quality value based on the circuit quality value of a certain flash by which is not a thing and fixed period are recording was carried out while this becomes possible to perform data communication with the suitable

transfer rate according to a situation, selection of a transfer rate will be performed more appropriately. Consequently, even if it uses the wireless circuit in which it tends to change circuit quality, it becomes possible to offer the radio communication equipment which can predict the quality of data communication more certainly.

[0024] A radio communication equipment according to claim 6 is set to a radio communication equipment according to claim 1. the time check which measures a duration after starting connection processing until it ends -- with a means A study value storage means to memorize the description of the circuit quality value accumulated in the duration of the connection processing in the past, and a fixed period before this connection processing as a study value, While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time whenever connection processing is completed It has a study value decision means to update to the new study value in which the duration measured with the means was made to reflect. the study value already memorized by the study value storage means -- the above-mentioned description and a time check -- [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The description of the circuit quality value accumulated in a fixed period of before at that time is searched for, and it is

characterized by predicting the duration of connection processing as quality of data communication based on the study value memorized by this description and the above-mentioned study value storage means.

[0025] whenever [ which performs data communication with a configuration according to claim 6 ] -- a time check -- a duration after starting connection processing until it ends is measured by the means, and the measured duration is memorized as a study value with the description extracted from the circuit quality value accumulated in a fixed period before the connection processing. Moreover, when a communication link quality prediction means predicts the quality of data communication, from the circuit quality value accumulated in a fixed period of before at that time, it extracts the description and predicts the duration of connection processing of this data communication based on the study value memorized by the description and the above-mentioned study value storage means which were extracted.

[0026] Moreover, the above-mentioned study value is always updated according to the description of the circuit quality value accumulated the duration of connection processing whenever data communication is performed, and then. That is, since the study value used as the criteria which predict the duration of connection processing as quality of data communication is always updated according to the situation, the dependability of the duration predicted can be

raised further. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and it becomes possible to offer the radio communication equipment which can predict quality of data communication effectively.

[0027] A radio communication equipment according to claim 7 is set to a radio communication equipment according to claim 1. the time check which measures a duration after starting data communication until it ends -- with a means A study value storage means to memorize the description of the circuit quality value accumulated in the duration of the data communication in the past, and a fixed period before this data communication, While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time whenever data communication is completed It has a study value decision means to update to the new study value in which the duration measured with the means was made to reflect. the study value already memorized by the study value storage means -- the above-mentioned description and a time check -- [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The description of the circuit quality value accumulated in a fixed period of before at that time is searched for, and it is characterized by predicting the time amount in which the continuation communication link of data is possible as quality of data

communication based on the study value memorized by this description and the above-mentioned study value storage means.

[0028] a duration whenever it performs data communication according to the configuration according to claim 7, after starting data communication until it terminates normally or terminates abnormally -- a time check -- it is measured by the means. The duration of the measured data communication is memorized by the study value storage means as a study value with the description extracted from the circuit quality value accumulated in a fixed period before this data communication. When a communication link quality prediction means predicts the quality of data communication, it predicts the time amount in which the continuation communication link of data is possible based on the description and the above-mentioned study value which are extracted from the circuit quality accumulated in a fixed period of before at that time.

[0029] Moreover, the above-mentioned study value is always updated reflecting the description of the circuit quality value accumulated time amount whenever data communication is performed, until data communication terminates normally or terminates abnormally, and then. That is, since the study value used as the criteria for predicting the time amount in which the continuation communication link as quality of data communication is possible is always updated according to the situation, the dependability of a forecast can be raised further. Consequently,

the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and it becomes possible to offer the radio communication equipment which can predict quality of data communication effectively.

[0030] A radio communication equipment according to claim 8 is set to a radio communication equipment according to claim 3, 6, or 7. It has a communication link activation means to choose and perform either from two or more kinds of data communication applications. When the above-mentioned study value storage means is equipped with the storage region which memorizes the study value according to each of selectable data communication application with the above-mentioned communication link activation means and the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurs While updating the study value memorized in the storage region according to the data communication application which the communication link activation means has chosen When the above-mentioned communication link quality prediction means predicts the quality of data communication, it is characterized by predicting using the study value memorized in the storage region according to the data communication application which the communication link activation means has chosen.

[0031] According to the configuration according to claim 8, the study value according to each of the data communication application which can be

performed with a communication link activation means is memorized to each field of a study value storage means, and a communication link quality prediction means predicts quality of data communication based on the study value according to the data communication application which the communication link activation means has chosen, when predicting the quality of data communication. Moreover, when the predetermined event about data communication generates the above-mentioned study value, the thing according to the data communication application chosen at the event is updated. For example, since the situations of data communication may also differ if data communication applications differ even if circuit quality is the same conditions, it becomes possible to predict the situation of data communication more exactly by memorizing the study value according to data communication application, and predicting like the above-mentioned configuration, using the study value according to the data communication application chosen. Moreover, since the study value according to each data communication application is always updated when this application is performed, it can raise the dependability of prediction further. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and it becomes possible to offer the radio communication equipment which can predict quality of data communication effectively.

[0032] A radio communication equipment according to claim 9 is set to a radio communication equipment according to claim 3, 6, or 7. The above-mentioned study value storage means is equipped with two or more kinds of storage regions which memorize the study value according to the magnitude of commo data. While updating the study value of the storage region corresponding to the magnitude of the commo data at the time of the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurring When the above-mentioned communication link quality prediction means predicts the quality of data communication, it is characterized by predicting using the study value of the storage region according to the magnitude of commo data.

[0033] According to the configuration according to claim 9, commo data is classified into two or more kinds, for example according to the magnitude of commo data, and the study value according to the magnitude of commo data is memorized to each field of a study value storage means. When a communication link quality prediction means predicts the quality of data communication, it predicts quality of data communication based on the study value according to the magnitude of commo data. Moreover, when the predetermined event about data communication occurs, the study value according to the magnitude of the commo data set as the communicative object

at the event is updated. For example, since the magnitude of the data which communicate differs even if circuit quality is the same conditions, and the situations of data communication may differ, it becomes possible by memorizing the study value according to the magnitude of data, and predicting like the above-mentioned configuration, using the study value according to the magnitude of commo data to predict the situation of data communication more exactly. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and it becomes possible to offer the radio communication equipment which can predict quality of data communication effectively.

[0034] A radio communication equipment according to claim 10 is set to a radio communication equipment according to claim 3, 6, or 7. The above-mentioned study value storage means is equipped with two or more kinds of storage regions which memorize a study value according to the identifier of the partner of data communication. While updating the study value of the storage region corresponding to the identifier of the communications partner at the time of the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurring It is characterized by the above-mentioned communication link quality prediction means predicting using the study value of the storage region according to the identifier of the

communications partner at the time of predicting the quality of data communication.

[0035] With the configuration according to claim 10, the study value for every identifier of the partner of data communication is memorized to each field of a study value storage means. In addition, as the above-mentioned identifier, the telephone number etc. corresponds, for example. Moreover, when a communication link quality prediction means predicts the quality of data communication, it predicts quality of data communication for the study value according to the identifier of the phase hand who is going to perform data communication based on ejection and this from a study value storage means. Furthermore, when the predetermined event about data communication occurs, the study value about the communications partner at the event is updated. For example, if communications partners differ even if circuit quality is the same conditions, the situations of data communication may differ for a reason which is said [ that the engine performance of a modem etc. may change with communications partners, for example and ]. For this reason, it becomes possible by memorizing the study value for every communications partner, and predicting like the above-mentioned configuration, using the study value according to a communications partner to predict the situation of data communication more exactly. Consequently, the situation of a wireless circuit of

tending to change circuit quality is grasped more exactly, and it becomes possible to offer the radio communication equipment which can predict quality of data communication effectively.

[0036]

[Embodiment of the Invention]

[Gestalt 1 of operation] It will be as follows if one gestalt concerning operation of this invention is explained based on drawing 1 thru/or drawing 25 .

[0037] With the gestalt of this operation, a wireless circuit is connected among phase hands using PHS, and the radio communication equipment which communicates the data (deemed voice) voice-ized by the modem is explained. PHS is the system which digitized the so-called conventional cordless telephone, and is constituted by the main phone arranged indoors, the public service base station installed in the outdoors, and the cordless handset connected to these both sides on radio.

[0038] The radio communication equipment concerning the gestalt of this operation memorizes the measured circuit quality serially, about the data communication which a user is going to perform based on such circuit quality, predicts the quality of data communication, such as the possibility of a success, and a duration, and has the function reported to a user while it carries out the firm measurement of the quality of the wireless circuit as radiotelephony with a

predetermined time interval.

[0039] In addition, "quality of data communication" shows the engine performance of the wireless circuit at the time of seeing from a viewpoint of performing data communication to the above-mentioned "quality of a wireless circuit" being what points out the quality of the wireless circuit at the time of performing a voice call, and it differs mutually. That is, the above-mentioned radio communication equipment makes it possible to ensure prediction of the quality of data communication by using as criteria of prediction of the study value according to a situation further using the quality of the wireless circuit accumulated from the event of there being the past rather than regarding only the field strength of a certain flash as quality of a wireless circuit like before and making this into the quality of ** data communication.

[0040] Drawing 1 is the block diagram showing the outline configuration of the radio communication equipment 100 as the above-mentioned radio communication equipment. The radio communication equipment 100 consists of the field strength test section 102 built in the wireless processing section 101 and this, the digital signal strange recovery processing section 103, the channel processing section 104, the voice codec section 105, the circuit quality test section 106, the circuit quality storage section 107, the data communication quality prediction section 108, the data communication quality study section 109,

a display 110, the data communication modem section 111, and the data communication application activation section 112.

[0041] The wireless processing section 101, the field strength test section 102, the digital signal strange recovery processing section 103, the above-mentioned channel processing section 104, and the above-mentioned voice codec section 105 are a part built in the cordless handset (PHS telephone) of PHS, and are usually fabricated as hardware of one. Moreover, these each part is usually used as a terminal for a voice call.

[0042] The circuit quality test section 106, the circuit quality storage section 107, the data communication quality prediction section 108, the data communication quality study section 109, a display 110, and the data communication modem section 111 are the parts about data communication. These are good also as a gestalt built in the cordless handset of PHS, or the cordless handset of PHS is possible also for considering as the configuration which is further equipped with the connection terminal which constitutes as hardware of another object, for example, is not illustrated, and connects and uses it for the cordless handset of PHS.

[0043] The data communication application (it is hereafter written as AP) activation section 112 is a part which performs data communication application. It becomes data communication application from the program for performing

various communication facility, such as a file transfer, a terminal function, a FAX communication link, or an electronic mail, etc. the above-mentioned data communication AP activation section 112 -- above-mentioned PHS -- the thing good also as a gestalt built in the hardware of a cordless handset, one, or another object which it carries out and is considered as a removable gestalt to the above-mentioned hardware like an IC card is also possible. It is good also as a gestalt which makes external connection of the personal computer with the function of the above-mentioned data communication AP section 112 etc. at a radio communication equipment 100.

[0044] Moreover, it is also possible to constitute the data communication modem section 111 and the data communication AP activation section 112 from hardware of another objects, such as a personal computer, to, make external connection of this in addition to this, at a radio communication equipment 100, and to consider as the gestalt which builds other blocks in the cordless handset of PHS.

[0045] Here, the function of each above-mentioned block is explained.

[0046] The wireless processing section 101 is the processing section about dispatch, reception, and the modulation of the radio signal used with a cellular phone, and measures field strength by the field strength test section 102. In order to use the fluctuation situation for measurement of data communication

quality, whenever it is measured, it is transmitted to the circuit quality storage section 107, and the field strength measured by the field strength test section 102 is not only used as a decision criterion of whether to be able to talk over the telephone in a voice call, but is memorized.

[0047] While the digital signal strange recovery processing section 103 carries out the digital recovery of the IF (intermediate frequency) signal inputted from the wireless processing section 101 and outputs baseband signaling to the channel processing section 104, it has the function which carries out digital modulation of the baseband signaling inputted from the channel processing section 104, and is outputted to the wireless processing section 101.

[0048] In the case of PHS, 4 phase phase modulation (pi / 4 shift QPSK) method is used as a method of the digital strange recovery in the above-mentioned digital signal strange recovery processing section 103. In addition, in a radio communication equipment 100, two recovery signals which are acquired at the time of a recovery and which intersect perpendicularly mutually are used for measurement of circuit quality. Therefore, a signal required for measurement of circuit quality, such as this recovery signal, is outputted to the circuit quality test section 106 from the digital signal strange recovery processing section 103.

[0049] The channel processing section 104 has the function to process the protocol for the channel codec processing in PHS, the extract of the data from

the data frame of PHS, and PHS communication links in a list, such as channel control of PHS. Since the frame be check simultaneously that it be the right in case the frame signal of PHS be take out from the baseband signaling which the result of having predict the propriety of the service in PHS be displayed on the display 110 , and also be received , the channel processing section 104 output the information refer to as whether to be whether the received frame be right and an error and the bit information on the frame itself to a circuit quality test section 106 , in order to use for measurement of circuit quality .

[0050] In PHS, while the voice codec section 105 changes into voice the digital data signal sent from the channel processing section 104 using the ADPCM (Adaptive Differential Pulse Code Modulation) method which is one of the voice coding methods, it changes voice into a digital data signal at the reverse.

[0051] The data communication modem section 111 performs a strange recovery between a data signal and voice, in order for deemed voice to perform data communication using the circuit which transmits voice. Moreover, this data communication modem section 111 outputs various information, such as those information, to the data communication quality prediction section 108 and the data communication quality study section 109, when the abnormalities in the middle of data communication etc. are detected in the start signal of line connection processing, the information about a success/failure in line connection

processing, a data transfer rate, and a list.

[0052] The data communication AP activation section 112 outputs the class of application, the size of the data to transmit, and the telephone number of the communications-partner point to the data communication quality prediction section 108 and the data communication quality study section 109 while performing application in the case of performing data communication.

[0053] The circuit quality test section 106 (measurement means) calculates the measured value (a circuit quality value is called henceforth) about circuit quality by the approach which was able to define beforehand the information about circuit quality of a wireless circuit which was described above for every reception and a certain fixed spacing from the digital signal strange recovery processing section 103 or the channel processing section 104. As this circuit quality value, the information on a recovery signal, a bit error rate, the rate of a framing error, etc. can be mentioned, for example. Each count approach of this circuit quality value is explained in full detail behind.

[0054] The circuit quality storage section 107 (circuit quality storage means) inputs the circuit quality value calculated with a fixed time interval by the above-mentioned circuit quality test section 106 each time, and carries out the sequential storage of these. That is, the sequential storage of the circuit quality value calculated within a fixed period from the event of there being the past is

carried out serially at the circuit quality storage section 107.

[0055] The data communication quality prediction section 108 (communication link quality prediction means) computes the various forecasts about the data communication which a user is going to perform after this using the circuit quality value memorized by the above-mentioned circuit quality storage section 107. the possibility of a success of the connection processing as these forecasts with the phase hand of data communication, the duration [ hand / of data communication / phase ] of connection processing, and the maximum of an available transmission speed (data transfer rate) -- the time amount which can communicate, the success percentage of data communication, required communication link time amount, estimated communication link time amount, etc. can be mentioned continuously.

[0056] Moreover, although behind explained in full detail on the occasion of calculation of the above-mentioned forecast, the information about the class of communication link application inputted from the data communication AP activation section 112, the size of the data which are going to perform data communication, and a phase hand etc. is taken into consideration besides the circuit quality value memorized by the circuit quality storage section 107 and the study value about the circuit quality of the past memorized by the data communication quality study section 109.

[0057] Moreover, the data communication quality study section 109 (study value decision means) In order to use as criteria at the time of predicting the quality of data communication, while memorizing the study value about the past circuit quality The description value is extracted from the circuit quality value which is before at that time whenever the predetermined event about data communication occurs, and is memorized by the circuit quality storage section 107, and this study value is updated by making this description value reflect. In addition, with the above-mentioned predetermined event, it is equivalent to failure or a success of connection processing for example, with a phase hand, failure in a data transfer, etc.

[0058] A display 110 (information means) is constituted by the liquid crystal display etc., and shows a user the data communication quality predicted by the data communication quality prediction section 108.

[0059] The data communication modem section 111 is the part which performs the strange recovery of data, in order to perform data communication which used deemed voice, and when sending a data signal using voice, it supports the protocol currently generally used. Since the protocol which generally changes with communication link applications to be used is adopted in many cases, the protocol corresponding to each of all the applications that a user uses needs to be prepared for the data communication modem section 111.

[0060] When using communication link application with a user, the data communication AP activation section 112 chooses the protocol corresponding to the application by sending a signal to the data communication modem section 111. Moreover, since the protocol which changes with classes of modem may be used even when using the same communication link application, the protocol which a communications partner uses needs to be prepared in the data communication modem section 111. The data communication modem section 111 determines first the protocol used during connection processing with a partner, before performing a data transfer, when performing the communication link with a partner.

[0061] The data communication modem section 111 detects the data transfer rate under data communication or a success/failure in handshake processing, the failure in the middle of data communication, etc., and inputs them into the data communication quality study section 109. In the data communication quality study section 109, study is started ignited by this input.

[0062] Moreover, the data communication modem section 111 inputs a data transfer rate into the data communication quality prediction section 108 in the midst of data communication.

[0063] The data communication AP activation section 112 is equipped with two or more communication link applications in order that a user may perform data

communication according to an application, and as shown in drawing 2 , it consists of the central-process section 701 and the data storage section 702 for a communication link. The data communication AP activation section 112 has the function to tell the class of application used, the size of the data to transmit, the telephone number of a communications partner, etc., in order to predict the communicability for every communication link application, communication link time amount, etc. in the data telecommunication line quality prediction section 108.

[0064] The data communication AP activation section 112 is formed into another object as hardware which became independent as mentioned above, and the configuration which makes external connection to a radio communication equipment 100 is also considered. For example, the data communication quality value with which itself may be the computer equipped with the display and was predicted to be in the data communication quality prediction section 108 in that case is sent to the application activation section 112, and becomes possible [ being displayed in this display ].

[0065] The example of activation in each communication link application is explained to below.

[0066] First, FAX transmission and reception are explained. Commercial production is already made and the FAX transceiver function using

radiocommunication is generalized. Although the thing which is made to scan a transmitting form and generally transmits the content to a partner and by which the printout of the received content is carried out to a form is in use, what transmits to a wireless circuit as FAX data as it is, without printing in a form the drawing and document which were drawn up with the personal computer, and the FAX data from a partner are incorporated to the hard disk of a direct computer etc., and a configuration which is displayed also on a display is also spreading widely.

[0067] A radio communication equipment 100 can predict by the time amount like which a content to transmit whether FAX transmission and reception are possible again can transmit using wireless, or to which part it can transmit by prediction of data communication quality.

[0068] The example which combined with drawing 3 (a) the configuration and PHS in which FAX transmission and reception are possible as an example of the hardware configuration of this radio communication equipment 100 is shown. Here, in the example shown in drawing 3 (a), the data communication AP activation section 112, the data communication modem section 111, and a display 110 are built in the FAX transmitter-receiver 120.

[0069] Moreover, drawing 4 (a) is other examples of the hardware configuration of this radio communication equipment 100, and combines the personal

computer 121 which carried the application for FAX transmission and reception, and PHS.

[0070] Furthermore, the application for FAX transmission and reception is built in a radio communication equipment 100, and drawing 5 (a) shows the example constituted as hardware of one.

[0071] Also in which configuration, the maximum applicable transmission speed, the possibility [ hand / phase ] of a success of connection processing, the duration of connection processing, the transfer duration according to the magnitude of the data to transmit, the time amount in which the continuation communication link of data is possible, or the amount of data which can be transmitted is predicted by the data communication quality prediction section 108, and the predicted result is inputted into a display 110. An example of the display result of a display 110 was shown in each of drawing 3 (b), drawing 4 (b), and drawing 5 (b).

[0072] In addition, although especially a user does not need to input the magnitude of transmit data since it can grasp in the data communication AP activation section 112 when a FAX transmitter-receiver is a computer, as shown in drawing 4 (a), in the FAX transmission by the transmitting form, it is desirable to have transmitting number of sheets and the structure as which a user can input the amount of information per sheet (a paper size, the number of

alphabetic characters, fineness, etc.) in the data communication AP activation section 112.

[0073] About under FAX data transmission, the data communication AP activation section 112 can update the value predicted by always checking the data communication residue and inputting into the data communication quality prediction section 108.

[0074] Next, a file transfer is explained as other classes of communication link application. The file transfer function which, and incorporates a partner's thing or carries out the document drawn up with the personal computer, data, and a drawing using radiocommunication is one of the fundamental data communication facility. [ a function ] [ transmitting to a partner ]

[0075] In this radio communication equipment 100, it can predict to decision whether a file transfer is possible, the duration of transmission, or which part of a file it can transmit using wireless by predicting data communication quality.

[0076] Drawing 4 (a) shows the example of a configuration of having combined the personal computer and PHS with built-in communication link application for file transfers. Moreover, as shown in drawing 5 (a), it is good also as a configuration in which exclusive application was contained by the radio communication equipment 100.

[0077] Also in these configurations, the class (data transfer) of application to be

used, the magnitude of the data to transmit, and the phase hand telephone number that will be transmitted if required are inputted into the data communication quality prediction section 108 from the data communication application activation section 112.

[0078] Consequently, the possibility of connection processing of the rate which can be communicated, and data communication by the data communication quality prediction section 108, Estimated time amount required for connection processing, communication link time amount required for the transfer by the magnitude of the data to transmit, It is displayed, as the estimated time amount (changed into the estimated amount of data in which a continuation transfer is possible when it is a file transfer) in which the continuation communication link of the data in the case of communicating is possible is predicted, it is inputted into a display 110 and data are shown in drawing 4 (b) or drawing 5 (b).

[0079] About a file transfer, the magnitude of data can be beforehand grasped at the time of transmission, and it can know the size of a partner's data using the information from a partner at the time of communication link initiation at the time of reception. The data communication AP activation section 112 can update the value (the remaining transfer time) predicted by always checking the data communication residue during data communication, and inputting into the data communication quality prediction section 108.

[0080] Next, a terminal function is explained as a class of further others of communication link application. For example, it is operated by accessing its own host computer and database of a firm, using radiocommunication from a going-out place, and required information is made to retrieve or the personal computer equipped with the terminal function which can perform a program is known. The personal computer communication service performed now also uses this function fundamentally. Moreover, transmission and reception of a certain kind of electronic mail etc. may use this function.

[0081] This function performs a long duration communication link in many cases, sometimes transmitting the short command for actuation rather than it transmits and receives the data of a large quantity, since a partner's host computer is operated. If a radio communication equipment 100 is used, by the terminal function through wireless, it can judge [ whether access to a partner is possible and ] like which whether time amount access can be carried out again, and the convenience for a user can be raised.

[0082] The example which combined the equipment (personal computer) which equipped drawing 4 (a) with the terminal function, and PHS is shown. In this example, the data communication AP activation section 112, the data communication modem section 111, and a display 110 are built in the personal computer 121. In addition, as shown in drawing 5 (a), even when the radio

communication equipment 100 is constituted as hardware of one, implementation is possible by building in the application for a terminal function.

[0083] From the data communication AP activation section 112, the application (terminal function) to be used and the phase hand telephone number which will be transmitted if required are inputted into the data communication quality prediction section 108 in a radio communication equipment 100. consequently, the data communication quality prediction section 108 -- the maximum of an usable transfer rate, the possibility of a connection processing success of data communication, and the duration of connection processing -- and the time amount in which data communication is possible is predicted continuously, and it is inputted and displayed on a display 110.

[0084] The data communication AP activation section 112 can update the value (estimated time amount in which data communication is possible) predicted in [ data communication ] as well as [ communication link before ].

[0085] As mentioned above, the data communication AP activation section 112 can be equipped with various kinds of communication link applications, and can realize them by the hardware configuration of various gestalten.

[0086] Next, a display 110 is explained. A display 110 displays the forecast of the data communication quality predicted in the data communication quality prediction section 108 in the condition intelligible for a user. In addition, as a

forecast of data communication quality, the success percentage of the maximum of a data transfer rate, the possibility of a connection processing success, the duration of connection processing, the time amount in which the continuous data transmission is possible, the transfer duration according to the magnitude of the data to transmit, and data communication etc. is mentioned, for example. These are explained in full detail behind. Moreover, according to the communication link application currently used, a required thing is chosen and such data communication quality is predicted.

[0087] Next, the processing which each above-mentioned block performs is explained to a detail about prediction of data communication quality.

[0088] First, the processing which the circuit quality test section 106 performs is explained. In the circuit quality test section 106, a circuit quality value is measured by the approach as shown below. Before activation of data communication, or irrespective of under data communication, with the predetermined time interval, the circuit quality test section 106 measures a circuit quality value, and is always outputting the measured circuit quality value to the circuit quality storage section 107. In addition, measurement of a circuit quality value is started from the event of the main power supply of a radio communication equipment 100 being set to ON condition. The measured circuit quality value is memorized by the circuit quality storage section 107, and is

behind used for prediction of the quality of data communication, and renewal of a study value.

[0089] Although there are some effective approaches as a measuring method of a circuit quality value, four kinds of following approaches are explained as a typical example in it here.

(a) How to act as the monitor of the eye pattern of a recovery signal, and to search for the error of a recovery signal.

(b) How to measure the rate of a framing error of a control channel.

(c) How to measure the bit error rate of a control channel.

(d) How to measure field strength.

[0090] First, the monitor of the eye pattern of the above-mentioned (a) recovery signal explains how to measure the error of a recovery signal. High-speed data transmission is needed with development of information communication technology in recent years, and the PE and the quadrature amplitude modulation method are adopted as a technique for it. In order to use the modem in order to perform data transmission using such a modulation technique, and to evaluate the engine performance of a modem, the noise in a transmission system, distortion, etc., using an eye pattern monitor is known from the former.

[0091] Here, an example of the conventional eye pattern monitor is shown in drawing 25 (a) and (b) for a comparison. As shown in this drawing (a), in the

conventional eye pattern monitor, the signal of the inphase component to which it restored, and a quadrature component is inputted, a noise, distortion, etc. in a transmission system are removed in an equalizer 200, the output is changed into an analog signal by DA converter 202 and 203, and it is observing with the wave observer 204 (monitor). Namely, the noise and distortion which were not able to be removed with an equalizer 200 can observe now with an eye pattern monitor as an error from the regular point.

[0092] Moreover, by the actual transmission system, in order that various distortion and noises may overlap and start, the technique of separating the element of a noise is indicated by JP,4-315339,A. By this technique, the recovery signal to observe is restricted using the physical relationship from the point of normal. The circuitry at this time is shown in this drawing (b). In this drawing (b), only when a limiter 220 compares a recovery signal with the regular point and a recovery signal is within the limits of predetermined, a recovery signal is latched by the latch circuit 221 and 222, and it outputs to an eye pattern monitor.

[0093] However, also in any of a configuration of having been shown in this drawing (a) and (b), in order to separate the element of the noise in a recovery signal thoroughly, the problem which should be solved further exists. That is, when it is difficult for a recovery signal with having outputted the recovery signal

as it was since various distortion and noises overlapped and it generated irregularly to specify the class of noise and the range to observe is restricted, there is also a problem that it is difficult to observe certainly the noise generated irregularly.

[0094] In order to solve these problems, the eye pattern monitor which this radio communication equipment 100 adopted is explained below.

[0095] pi / 4 shift QPSK method is used for PHS as a strange recovery method. The inphase component and quadrature component of a signal to which it restored are inputted into the circuit quality test section 106 from the digital signal strange recovery processing section 103 which is performing the strange recovery with pi / 4 shift QPSK method. The circuit quality test section 106 is equipped with the wave Observations Department which mentions later, and searches for the coordinate of the recovery signal on the two-dimensional space based on an eye pattern diagram at this wave Observations Department based on an above-mentioned inphase component and an above-mentioned quadrature component.

[0096] Drawing 6 shows the example of the eye pattern observed at time of day t. Point [ of the normal at this time ] A (t) It can express with the following (1) type. In addition, j in a formula is an imaginary unit and expresses the direction of a quadrature component.

A (t) =ar(t)+j* ai (t) ... (1)

The error by the noise can join the point of normal and the recovery signal which passed along the equalizer which is the point of the time of day t observed with an eye pattern monitor can be expressed with it as (2) types.

Z (t) =Zr(t)+j* Zi (t) =(ar(t)+er(t)) +j* (ai(t)+ei(t)) ... (2)

However, the inphase component ei of the noise in the quadrature-component er(t):time of day t of the regular point in the inphase component ai(t):time of day t of the regular point in the quadrature-component ar(t):time of day t of the recovery signal in the inphase component Zi(t):time of day t of the recovery signal in the Zr(t):time of day t (t): It is the quadrature component of the noise in time of day t.

[0097] At this time, the noise component of the amplitude direction is on the extension wire to the point regular from a zero, as shown in drawing 6 . That is, the noise of the amplitude direction is theta (t). = tan-1 (ar (t)/ai (t))

It is in ******. In order to express this noise component as an error from a zero and to express as the noise of the amplitude direction, and a noise of the phase direction, it is necessary to change the point of normal into a zero and to arrange the amplitude direction in the same direction. for that purpose, the include angle and hard flow in which the parallel displacement (subtraction) only of the magnitude of the point of normal is carried out, and the point of normal has it

from (2) types -- theta (t) only -- what is necessary is just to rotate namely, -- (-- Z (t)-A (t)) -theta (t) only -- it will rotate.

[0098] Point [ of normal ] A (t) The component (component of an include angle theta) of the same direction as the point of normal is convertible for an include angle 0 by applying (3) types which broke by distance from a zero to the point of normal what made the sign of a quadrature component reverse to (2) types.

[0099]

Y (t) =(ar(t)-j*ai (t))/(ar(t)2+ai2 (t)) ... (3)

This (3) type has the point of normal, and the include angle of reverse, and expresses the point whose magnitude is 1. That is, by applying (3) types, magnitude does not change but only the include angle of the point of normal is rotated to an opposite hand.

(Z(t))-A(t) = * Y (t) (er(t) *ar(t)+ei(t) * ai (t) +j*(ri(t) * ar(t)-er(t) * -- ai (t)) /(ar(t)2+ai2 (t)) ... (4))

What is necessary is just to display the point expressed with (4) types as mentioned above.

[0100] Here, the example of a configuration of the wave Observations Department for calculating the above-mentioned (4) types is explained based on the block diagram of drawing 7 . In this drawing, the configuration of common knowledge, such as an oscilloscope, can be used, for example as an equalizer

200, the judgment machine 201, DA converter 202-203, and a wave observer 204.

[0101] Next, the part which has realized the above-mentioned (4) types is explained according to this drawing. In order to take out the noise component er (t) and ei (t) from a recovery signal, the parallel displacement of the recovery signal is carried out to the zero of 2-dimensional space from the recovery signal Zr (t) and Zi (t) by lengthening the point ar of normal (t), and ai (t) by the adder 208 and 209, respectively.

[0102] Furthermore, in order to rotate a noise component, it is calculating with the multiplier 210 thru/or 213 and an adder 214-215. The output of the adder 214-215 which is this result of an operation can be changed into an analog signal with DA converter 202-203, and can be observed by viewing with the wave observer 204. In addition, this wave observer 204 is good also as a removable configuration through a connection terminal. Moreover, the input of DA converter 202-203 is constituted so that it can change to the output side of an equalizer 200 with a switch 216-217, and it is also possible to carry out direct observation of the recovery signal Zr (t) and the Zi (t) with the wave observer 204.

[0103] In addition, in order to realize division process in (4) types, the reference-value generator 207 was formed and magnitude has generated ar' (t) of 1, and ai' (t) at the point ar of normal (t), and the same include angle as ai (t).

ar' (t) generated by this reference-value generator 207, and ai' (t) Although it can also generate simultaneously when preparing in the judgment machine 201 and generating the regular point since it corresponds to the regular point and 1 to 1, an example of the concrete circuitry of the above-mentioned reference-value generator 207 in the case of preparing in the exterior of the judgment machine 201 is shown in drawing 8 here.

[0104] Drawing 8 is a circuit corresponding to the quadrature amplitude modulation specified by pi / 4 shift QPSK method. The point of the normal of the eye pattern specified by pi / 4 shift QPSK method is 0 degree and 45 degrees, as shown in drawing 9 . -- It is in each location of 270 " and 315 ". Using this, the reference-value generator 207 is designed, as shown in drawing 8 . When it is 45 degrees, 135 ", 225 ", and 315 " when the magnitude of the absolute value of an inphase component and a quadrature component is equal namely Magnitude is restricted to **1/root2 by the limiter 238, and one of an inphase component and the quadrature components is 0. When it is 0 degree, 90 degrees, 180 ", and 270 ", magnitude is restricted to **1 by the limiter 237. This circuit can be adapted to the eye pattern which has the point of normal every 45 degrees like drawing 9 .

[0105] Moreover, in the above-mentioned circuit, when the magnitude of the absolute value of an inphase component and a quadrature component is equal,

in a rectifier 231-232, the absolute value of ar (t) and ai (t) is taken, an exclusive OR 233 compares the absolute value, and it is made further reversed by the inverting circuit 234. Since the output of an exclusive OR 233 is set to 0 when the magnitude of the absolute value of an inphase component and a quadrature component is equal, the output of an inverting circuit 234 is set to 1.

[0106] Moreover, in order to detect that one of an inphase component and the quadrature components is 0, a product is taken with a multiplier 235. When one of an inphase component and the quadrature components is 0, the output of the above-mentioned multiplier 235 is set to 0, it is reversed in an inverting circuit 236, and 1 is obtained. The output of a limiter 237-238 is chosen by AND 239-240-241-242. The output of the limiter circuit chosen by AND 239 thru/or 242 passes along OR 243-244, and is output ar[ of a reference-value generator ]' (t), and ai' (t). It is outputted by carrying out.

[0107] The example of the eye pattern obtained by the above configuration is shown in drawing 10 (a) thru/or (c), respectively. Eye patterns are circularly scattered about from the point of normal by the case where this drawing (a) has only white noise in a transmission system. This drawing (b) serves as dispersion whose breadth an eye pattern has in the phase direction (the direction of a quadrature component) by the case where a phase jitter (noise by which a phase swings) joins white noise. In this drawing (c), an eye pattern becomes dispersion

to which it spread in the amplitude direction (the direction of an inphase component) by the case where an amplitude jitter (noise by which the amplitude swings) goes into white noise.

[0108] Thus, according to the above-mentioned configuration, it becomes possible to observe how much the recovery signal is shifted from the point of normal considering the zero of 2-dimensional space as the point of normal. That is, it can judge easily which the impulse shall have influenced between a phase and the amplitude also about the noise of the impulse nature generated irregularly that what is necessary is just to observe only paying attention to the zero of 2-dimensional space. Moreover, it also becomes possible by displaying the above-mentioned eye pattern on an oscilloscope etc. to check easily what kind of property the noise has by viewing.

[0109] the difference shown in drawing 7 -- the calculator 205 is formed in order to detect how much the recovery signal is shifted from the point of normal, and it searches for the error of the point of the nearest normal, and the coordinate of a recovery signal. here -- difference -- the effect a calculator 205 affects circuit quality as shown in drawing 11 shall measure the noise of the large phase direction namely, difference -- a calculator 205 measures the error of the phase direction of the recovery signal with which the point of normal receives, and it is outputted to the circuit quality storage section 107 as a circuit quality value, and

it is made to memorize it

[0110] The circuit quality test section 106 performs processing which the circuit quality storage section 107 is made to memorize at the wave Observations Department as mentioned above in quest of the error from the point of the normal of two or more recovery signals by which the map was carried out to two-dimensional space with a predetermined time interval. And after a certain fixed period defined beforehand passes, the circuit quality test section 106 asks for the average of these errors that the circuit quality storage section 107 was made to memorize. The average called for here is the circuit quality value of the event of there being the past to the event. When circuit quality is good, since there is little dispersion from the point of the normal of a recovery signal, the average with error turns into a small value, but since dispersion from the point of the normal of a recovery signal becomes large when circuit quality is bad, the average with error becomes large.

[0111] Next, how to measure the rate of a framing error of the (b) control channel is explained. In this case, as shown in drawing 12 , the rate test section 301 of a framing error which asks for the error rate of a receiving frame is formed in the circuit quality test section 106. From the channel processing section 104, the rate test section 301 of a framing error inputs the information on whether the error was in the receiving frame, and outputs it to the circuit quality storage 107

by making into a circuit quality value the rate of a framing error computed based on this information.

[0112] The channel processing section 104 detects whether an error is in a receiving frame by CRC decryption. In the rate test section 301 of a framing error, the framing error to the number of the frames correctly received in a certain fixed time amount defined beforehand computes comparatively (rate of a framing error), and let this be a circuit quality value. In addition, since it is necessary as a target receiving frame to predict data communication quality before a user performs data communication processing, PHS gets down and the frame for control in a control channel (getting down control slot) is used here. It gets down and an example of a control slot is as [ this ] being shown in drawing 13 (a).

[0113] Moreover, you may make it a frame output the information of being an error itself as a circuit quality value instead of a rate of a framing error which was described above. That is, for example, if there is no error into a receiving frame, "1" will be outputted, and if there is an error, the rate test section 301 of a framing error is constituted so that "0" may be outputted. This is equivalent to making fixed time amount of the above used in case it asks for the rate of a framing error into the time amount which can receive only one frame.

[0114] The value calculated for every inside of fixed time amount is outputted to the circuit quality storage section 107. Moreover, while the user is performing

data communication, it can get down and the rate of a framing error can be computed using a communication link slot or a going-down control slot. It gets down and an example of a communication link slot is as [ in PHS ] being shown in drawing 13 (e).

[0115] Then, how to measure the bit error rate of the (c) control channel is explained. This approach is the approach of measuring the bit error in the frame of the control channel in PHS for measurement of the circuit quality in PHS. In this case, the circuit quality test section 106 is equipped with the bit error rate test section 304 which consists of the bit pattern collating section 302 and the reference bit pattern storage section 303 as shown in drawing 14 .

[0116] The above-mentioned bit pattern collating section 302 inputs the frame signal before a CRC decryption is carried out from the channel processing section 104. In addition, since the frame inputted here needs to predict data communication quality before a user performs data communication processing, the specification in PHS gets down and a control channel is used for it. For example, SCCH and BCCH as shown in drawing 13 (b) thru/or (d), respectively, or PCH can be used.

[0117] In PHS, in order to usually use for a synchronization, as shown in drawing 13 (b) thru/or (d), it gets down and a fixed bit pattern exists on the preamble of each slot of a control channel, or synchronous WORD. Such a fixed bit pattern is

beforehand memorized by the reference bit pattern storage section 303, and the bit pattern collating section 302 detects the bit error in a frame in it by comparing the fixed bit pattern memorized by the reference bit pattern storage section 303 with the bit pattern of a frame inputted from the channel processing section 104.

[0118] Moreover, it gets down and SCCH of a control channel, BCCH, or PCH has a thing including the information same periodical respectively like ********** shown in drawing 13 (b) thru/or (d). Therefore, it can also use for everything but the above-mentioned preamble and synchronous WORD for bit error measurement of such information. In addition, when channel structure information, system information, etc. are in BCCH and a system does not change that content frequently, it is also possible to perform bit error measurement based on this information.

[0119] In this case, bit patterns, such as the above-mentioned ********** part, are memorized by the reference bit pattern storage section 303 as a bit pattern for reference. In addition, since the above-mentioned bit pattern is not necessarily fixed, whenever it is changeful, it is necessary to update the bit pattern for the reference in the reference bit pattern storage section 303. However, when a reception error receives the same bit pattern more than a certain count of fixed in consideration of the case where a bit pattern changes, it is desirable to update the bit pattern for reference.

[0120] The bit error to the right bit within a certain fixed time amount defined beforehand calculates the bit pattern collating section 302 comparatively (bit error rate), it is outputted to the circuit quality storage section 107 by making the calculated bit error rate into a circuit quality value, and is made to memorize. In addition, also while the user is performing data communication, it is possible to get down and to measure a bit error rate using a control slot.

[0121] Moreover, you may make it a bit pattern output the information of being the right itself as a circuit quality value instead of the above-mentioned bit error rate. That is, for example, a bit outputs "1" to a right case, and if a bit is an error, "0" will be outputted. This is equivalent to making into time amount receivable only 1 bit fixed time amount of the above used in case a bit error rate is searched for.

[0122] Next, how to measure (d) field strength is explained. Although the field strength only at a certain event does not necessarily have a correlation with the quality of data communication as described above, the situation of fluctuation of field strength may affect the quality of data communication. For this reason, field strength is measured by the field strength test section 102 for every fixed time amount, and it outputs to the circuit quality storage section 107 as a circuit quality value. In addition, although this field strength itself mentions later rather than it is used as a circuit quality value, the situation of fluctuation of field

strength etc. is extracted as a description, and it is used for prediction of the quality of data communication.

[0123] As mentioned above, the error from the point of the normal of a recovery signal, the rate of a framing error, a bit error rate, or field strength is measured in the circuit quality test section 106, and is memorized to the circuit quality storage section 107.

[0124] Next, the circuit quality storage section 107 prepared in order to memorize a circuit quality value is explained. The circuit quality storage section 107 is constituted by memory etc., and as shown in drawing 15 , it memorizes serially the circuit quality value measured with the fixed time interval by the circuit quality test section 106. In addition, the number of the circuit quality value memorized is beforehand decided to be N individual. However, N is one or more integers. That is, the circuit quality storage section 107 is equipped with the storage region of N individual in order to memorize the data of N individual one by one.

[0125] New data will be overwritten by the part where the oldest data are memorized, if the following circuit quality value is inputted when the data of N individual are already memorized by the circuit quality storage section 107. The circuit quality value memorized by the circuit quality storage section 107 is taken out and used for order with the old data of N individual memorized, in case the

data communication quality prediction section 108 predicts data communication quality. Moreover, at the time of a connection processing success at the time of data communication initiation or failure, and failure in data communication, for study by the data communication quality study section 109, the data of N individual memorized are taken out from old order, and are sent to the data communication quality study section 109.

[0126] Next, the processing which predicts the quality of the data communication which a user is going to perform is explained to a detail. It is characterized by a radio communication equipment 100 predicting quality of data communication using a study value, and this study value is updated whenever the predetermined event about data communication occurs. Here, the update process of a study value which the data communication quality study section 109 mainly performs is explained first.

[0127] In order that the data communication quality study section 109 may make the situation at the time of that event occurring whenever the predetermined event about data communication occurred about the study value reflect in a study value, it extracts the description value from the circuit quality value accumulated in the circuit quality storage section 107 at that event, and performs processing which updates a study value using this description value.

[0128] In addition, data communication will be calculated in the circuit quality

storage section 107 from two or more circuit quality values accumulated serially by the event of succeeding or failing from the event of the past instead of the circuit quality value of the flash which succeeded or went wrong having data communication with the description value of the circuit quality value extracted here. That is, the data communication quality study section 109 calculates the description value from the circuit quality value of N individual memorized by the circuit quality storage section 107, when a predetermined event occurs. And a new study value is computed using the calculated description value.

[0129] In addition, the soundness of prediction can be raised by having two or more study values according to the conditions of data communication. That is, it is desirable to set up a study value corresponding to each of the combination of various conditions, such as application of data communication, a transfer rate which each application applies, a communicative phase hand, and size of commo data. That is, it is because it is possible that the quality of the data communication to circuit quality changes with combination of these conditions.

[0130] Moreover, general classification of data communication constitutes it from connection processing with a phase hand, actual data transfer processing, and processing of the three-stage of the post process after data transfer termination. In each of these phases, respectively, in order to predict more certainly the possibility of a success of the data communication which a user is going to

perform since it differs, as for the content of the processing which data communication modem section 111 grade performs, it is desirable to predict the possibility of a success of processing of each phase independently.

[0131] A radio communication equipment 100 For this reason, the application of data communication, while the combination of various conditions, such as a transfer rate which each application applies, a communicative phase hand, and size of commo data, is alike, respectively, corresponding and memorizing two or more study values As a predetermined event used as the opportunity which updates a study value, it is (1). When connection processing with a phase hand is successful in early stages of data communication, (2) It is (3) when connection processing with a phase hand goes wrong in early stages of data communication. When actual data transfer goes wrong, renewal of a study value is performed to three kinds of events of **. In addition, the study value is established for the three above-mentioned kinds of every events, and the required information on other is acquired from data communication modem section 111 grade, and it is used while the various description values are extracted from two or more circuit quality values of the circuit quality storage section 107 on the occasion of renewal of the study value by which the study value corresponding to the event is updated, when each event occurs. Above (1) (2) And (3) The study example value which is updated in each case is explained.

[0132] First, (1) It is the following (a) when connection processing is successful. ** [ there is nothing ] The study value of (g) is updated. Moreover, these study values are memorized according to each of the combination of the conditions of a data transfer rate and communication link application. That is, when five kinds and communication link application have four kinds of usable data transfer rates, the study value corresponding to 20 kinds of conditions which are these combination will exist. In addition, the following circuit quality value points out the circuit quality value of N individual all memorized by the circuit quality storage section 107.

(a) average (**) of a circuit quality value Average (**) of the variation of a circuit quality value Minimum value (**) of a circuit quality value Maximum (**) of a circuit quality value Count (mosquito) to which the circuit quality value was changed beyond from the boundary value to below the boundary value Count (g) in which the circuit quality value was less than the boundary value (**) of the time amount above from initiation of connection processing to the completion of connection ** [ there is nothing ] (mosquito) It is updated using the description value extracted from the above-mentioned circuit quality storage section 107.

[0133] Moreover, (2) It is the following (h) when connection processing goes wrong. ** [ there is nothing ] The study value shown in (**) is updated. These study values are memorized according to each of the combination of a data

transfer rate, a communicative phase hand, and the conditions of communication link application.

(h) Average (**) of a circuit quality value Average (**) of the variation of a circuit quality value Minimum value (**) of a circuit quality value Maximum of a circuit quality value (Si) Circuit quality value (**) of a flash in which connection processing failed Count (**) to which the circuit quality value was changed beyond from the boundary value to below the boundary value A circuit quality value a boundary value Count (**) than which were less (h) of the time amount above after starting connection processing until it fails Or (**) It is updated using the description value extracted from the above-mentioned circuit quality storage section 107.

[0134] Furthermore, (3) It is the following (**) when data transfer goes wrong. ** [ there is nothing ] (j) is learned as a description value. These study values are memorized according to each of the combination of a data transfer rate, a communicative phase hand, and the conditions of communication link application.

(**) Average (**) of a circuit quality value Average of the variation of a circuit quality value (Thu) Minimum value (**) of a circuit quality value Maximum (**) of a circuit quality value Circuit quality value (**) of a flash in which data communication failed Count (**) to which the circuit quality value was changed

beyond from the boundary value to below the boundary value Count (**) in which the circuit quality value was less than the boundary value Time amount after starting data transfer until it fails (continuation transfer time)

Above (**) Or (d) It is updated using the description value extracted from the above-mentioned circuit quality storage section 107.

[0135] In addition, with the above-mentioned boundary value, it considers as the study value of the circuit quality value at the time of failure in connection processing or failure in data transfer taking place in the past. In addition, although this boundary value is calculated for every data transfer rate, a user may be made to set a value as arbitration. Moreover, (j) It is (**) if it attaches. It is computed only when it is below fixed criteria with the difference of a value and the circuit quality value at the connection processing success event.

[0136] The description value corresponding to each above-mentioned study value is shown in drawing 16 . Above (a) (h) (**) The description value reflected is the average of the circuit quality value of N individual memorized by the circuit quality storage section 107. Moreover, (b) (i) (h) The description value reflected calculates the absolute value of the difference of the data which adjoin a time series target in the circuit quality value of the above-mentioned N individual, respectively, and averages them further. (**) -- (**) (Thu) And (d) (**) (**) The description values reflected are the minimum value of the circuit quality values of

N individual, and maximum. (e) (**) (**) A circuit quality value is the count changed in Shimo's condition from the boundary value from the condition above a boundary value. (Mosquito) (**) (d) It is the number of the circuit quality value which is in the condition below a boundary value among the circuit quality values of N individual.

[0137] In addition, the value same as a boundary value about a connection processing success as the boundary value about connection processing failure can be used. Moreover, it thinks that it is equivalent to failure in connection processing also when transmission speed changes from a high speed to a low speed in the data communication modem section 111, and is above (h). Or (**) Each is called for.

[0138] As mentioned above, whenever a success / failure in connection processing, or failure in data communication occurs, the description value is extracted from the circuit quality value of N individual memorized by the circuit quality storage section 107. The study value of each description value is updated based on the description value which it could come, simultaneously was asked for the data communication quality study section 109 in this way. That is, the study value calculated and memorized by several one in the data communication quality study section 109 in the following past is updated, respectively.

[0139]

[Equation 1]

$$\text{新しい学習値} = \frac{\text{今までの学習値} \times \text{今までの学習回数} + \text{今回求められた特徴値}}{\text{今までの学習回数} + 1}$$

[0140] The these-memorized study value is taken out as criteria of prediction, when predicting data communication quality in the data communication quality prediction section 108. Moreover, when performing data communication and the study value according to the partner's telephone number already exists, the study value is also doubled and taken out by a user's selection.

[0141] Here, the configuration of the data communication quality study section 109 is explained, referring to drawing 17 . the data communication quality study section 109 -- the description value extract section 641, the study value calculation section 642, the condition storage section 643, and a time check -- it has the section 644 and the study value storage section 645 (study value storage means).

[0142] The description value extract section 641 inputs the circuit quality value of N individual memorized by the circuit quality storage section 107, and extracts the description value in data communication quality from these circuit quality values.

[0143] In addition to acquiring and memorizing the class of application used, the telephone number of a communications partner, etc. from the data

communication AP activation section 112, the condition storage section 643 acquires advice signals, such as a success/failure in connection processing, and failure in data communication, a data transfer rate, etc. from the data communication modem section 111 in a connection processing start signal and a list.

[0144] Moreover, the study value calculation section 642 will send the study value corresponding to the condition to ejection and the data communication quality prediction section 108 from the study value storage section 645, if the class of communication link AP and the telephone number of a communications partner which are used for the condition storage section 643 are inputted in order that the data communication quality prediction section 108 may predict data communication quality. Furthermore, make the description value from which the study value which agrees to the conditions memorized by the condition storage section 643 whenever a success / failure in connection processing, or failure in data communication arose was extracted by ejection and the description value extract section 641 from the study value storage section 645 reflect, a study value updates, and the study value calculation section 642 makes the study value storage section 645 memorize the result again.

[0145] The study value as a result of the study performed in the past is memorized for every conditions of data communication by the study value

storage section 645, respectively. Here, the study value is memorized according to the combination of a communications partner, communication link application, and the various conditions of a data transfer rate. When the study value memorized is taken out when newly computing a study value, and also predicting data communication quality in the data communication quality prediction section 108, the study value suitable for the conditions specified from the data communication quality prediction section 108 is taken out by the study value calculation section 642, and it is outputted to the data communication quality prediction section 108.

[0146] It is as follows when the data communication quality study section 109 explains the procedure of the study performed at the time of connection processing here based on the flow chart of drawing 18 .

[0147] When communication link application starts processing, the data communication quality study section 109 acquires the class of the communication link application, and the telephone number of the communications-partner point from the data communication application activation section 112, and memorizes them in the condition storage section 643 (in step 1 and the following, it writes like S1).

[0148] next -- if connection processing with the communications-partner point is started by the modem -- the information on a connection processing start signal

and a data transfer rate -- from the data communication modem section 111 -- inputting (S2) -- a time check -- the section 644 resets a timer according to the above-mentioned connection processing start signal, and starts measurement of the duration of connection processing (S3).

[0149] Then, when the signal of a connection processing success with a phase hand is received from the data communication modem section 111 (it sets to S4 and is YES), the study value about a connection processing success is updated (S5). About the detail of this processing of S5, it mentions later. When the signal which, on the other hand, notifies having changed the signal or transfer rate of connection processing failure from the high speed to the low speed from the data communication modem section 111 is received (it sets to S4 and is NO), the study value about connection processing failure is updated (S6). It mentions later also about the detail of this processing of S6.

[0150] Since data communication processing is continued when connection processing is successful, the start signal and data transfer rate of data communication processing are acquired from the data communication modem section 111 after termination of S5 (S7). furthermore, a time check -- the section 644 resets a timer according to the above-mentioned start signal, and starts measurement of the duration of communications processing (S8).

[0151] Then, when the signal with which the signal or transfer rate which tells

failure in data communication notifies having changed to the low speed from a high speed is received from the data communication modem section 111 (it sets to S9 and is NO), processing which updates the study value about data communication failure is performed (S10). It mentions later also about the detail of this processing of S10.

[0152] It is as follows when here explains the detail of processing of the above of S5, referring to the flow chart shown in drawing 19 .

[0153] First, the object of study is determined according to a transfer rate and the class of communication link AP (S101). next, a time check -- the timer of the section 644 is suspended, measurement of the duration of connection processing is stopped, and the study value of a connection processing duration is updated based on this measurement result (S102). That is, the study value calculation section 642 acquires the duration of the connection processing memorized by the study value storage section 645 as a study value, calculates the new study value which made this measurement result reflect in this, and stores in the study value storage section 645.

[0154] Next, the description value extract section 641 takes out the circuit quality value of N individual by which sequential storing was carried out into the predetermined time amount from the circuit quality storage section 107 to this time (S103). The study value calculation section 642 calculates the average of

the circuit quality value of these N individual, acquires the average of the circuit quality value of the past memorized by the study value storage section 645 as a study value, makes this average reflect in this, calculates a new study value, and stores it in the study value storage section 645.

[0155] While asking for the count to which the average of the variation, maximum and the minimum value, and a circuit quality value were changed below to the boundary value, and the count to which the circuit quality value was less than the boundary value in S104 thru/or S108 similarly hereafter, respectively from the circuit quality value N individual acquired from the circuit quality storage section 107, these values are made to reflect in the study value acquired from the study value storage section 645, and it updates.

[0156] Moreover, the detail of S6 and processing of S10 of drawing 18 is as the flow chart shown in drawing 20 and drawing 21 , respectively.

[0157] Next, prediction processing of the data quality which the data communication quality prediction section 108 mainly performs is explained using the study value learned as above-mentioned.

[0158] The data communication quality prediction section 108 takes out the required description value from the data of a fixed period about the current circuit quality value memorized by the circuit quality storage section 107. Moreover, the study value which serves as criteria which predict data communication quality

from the data communication quality study section 109 is taken out. In this case, when the study value about the time of data communication failure is learned in the past at the time of connection processing failure at the time of a connection processing success to a communicative phase hand's telephone number, this study value is taken out.

[0159] From the data communication modem section 111, if it is during the signal of data communication initiation, and data communication, the transfer rate set up will be inputted. From the data communication AP activation section 112, the class of communication link application to be used, the size of the data to transmit, and a phase hand's telephone number are inputted. The data communication quality prediction section 108 predicts data communication quality based on the conditions inputted in this way.

[0160] The values predicted as data communication quality are the success percentage of the communication link according to the class of the time amount in which the success possibility [ hand / for example, / phase ] of connection processing, the duration [ hand / phase ] of connection processing, the maximum applicable data transfer rate, and the continuation communication link of data are possible, and data communication application to be used, the duration of data transfer, time amount by which the circuit is connected with the phase hand.

[0161] Moreover, these prediction can also perform prediction according to the

study value by a user's selection, when study to a phase hand's telephone number is performed and a study value already exists in the past.

[0162] Moreover, the above-mentioned forecast is expected before initiation of data communication, the midst by which data communication is performed changes the bit rate acquired from the data communication modem section 111 to the forecast of a bit rate, and it is used, and it is used in order to update other forecasts. A user is notified of the predicted value by the display 110 at any time.

[0163] Here, the configuration and its actuation of the data communication quality prediction section 108 are explained in more detail. The data quality prediction section 108 consists of the description value extract section 821, the data communication quality forecast calculation section 822, the study value storage section 823, and the condition storage section 824, as shown in drawing 22 .

[0164] In the description value extract section 821, the description value is extracted from the data of the circuit quality value of N individual taken out from the circuit quality storage section 107 by the same approach as the description value extract section 641 of the data communication quality study section 109.

[0165] The condition storage section 824 inputs and memorizes the class of communication link application, and the telephone number of a communications partner, and takes out the study value which was suitable for conditions from the

data communication quality study section 109 from the data communication AP activation section 112 based on this. The study value storage section 823 stores temporarily the study value taken out from the data communication quality study section 109, and uses it for count of prediction of data communication quality.

[0166] Based on the description value taken out from the description value extract section 821, and the study value memorized by the study value storage section 823, the data communication quality forecast calculation section 822 computes the forecast of data communication quality, and outputs it to a display 110. Moreover, the forecast computed depending on the case is outputted also to the data communication AP activation section 112.

[0167] The procedure of prediction of data communication quality is explained based on drawing 23 .

[0168] From the data communication AP activation section 112, the class of communication link application to be used, the telephone number of a communications partner, and the size of the data which communicate are sent beforehand (S21). Then, when a user predicts data communication quality, the description value extract section 821 extracts the description value [ in / for the data of the circuit quality value of N individual / ejection and its data ] from the circuit quality storage section 107 (S22). Here, the description values to extract are the count changed to the average of the circuit quality value of N individual,

the average of a variation, maximum, the minimum value, and below a boundary value, the count which became below the boundary value, as mentioned above.

[0169] Furthermore, the study value according to data communication conditions is taken out from the data communication quality study section 109 (S23). A forecast is calculated about the quality of the following data communication using the aforementioned description value and the above-mentioned study value. In addition, as for whether prediction according to the telephone number of a communications partner is performed, a user chooses beforehand.

[0170] Next, the maximum applicable bit rate is predicted. First, since there are some to which the transmission speed used depending on the class of communication link application is restricted, about those applications, the selection range of transmission speed is narrowed down only to the candidate of an usable transmission speed (S24).

[0171] Then, the count which became below the boundary value at the time of the connection processing failure in the study value corresponding to each of the count which the circuit quality value in the description value extracted by S22 became below the boundary value, and the candidate of transmission speed is measured, and the transmission speed which fulfills the conditions that the former is below the latter is chosen (S25). Here, when all candidates do not fulfill conditions, it is predicted that connection processing is impossible (S26).

[0172] About the transfer rate chosen by S25, it is the following approach and the possibility of connection processing is judged further. The circuit quality value at the time of connection processing failure in the study value to the candidate of the transmission speed as which the circuit quality value in the description value currently extracted by S22 was chosen beyond from the boundary value by S25 with the count changed below to the boundary value measures the count changed from beyond the boundary value below to the boundary value, and chooses the transmission speed which fulfills the conditions that the former is below the latter (S27). Here, when all candidates do not fulfill conditions (it is NO at S28), it is predicted that connection processing is impossible (S37).

[0173] Furthermore, the count changed to below the boundary value beyond from the boundary value at the time of a connection processing success in the study value to the candidate of the transmission speed as which the circuit quality value in the description value currently extracted by S22 was chosen beyond from the boundary value by S27 with the count changed below to the boundary value is measured, and the transmission speed which fulfills the conditions whose former is below the latter is chosen (S29).

[0174] When S29 was ended and transmission speed is extracted to one, let the transmission speed be prediction transmission speed. Or if there is no selection

candidate (it is NO at S30), it will shift to S37 and it will be predicted that data communication is impossible. Or when the candidate of transmission speed cannot finish extracting to one, transmission speed with the average of the circuit quality value in the extracted description value nearest to the study value of an average of the circuit quality value at the time of a connection processing success is determined as a prediction transmission speed (S31). In addition, the following prediction may be continued about two or more transmission speed which remained as a candidate, without extracting prediction transmission speed to one here depending on the case.

[0175] In addition, in processing of S29 and S30, when a selection candidate is always lost, it is good also as a procedure which does not perform this processing but is skipped to S31 from S28.

[0176] Next, the possibility of a connection processing success is predicted to the transmission speed chosen by processing to the above S31 based on the following several 2 (S32). That is, the possibility of a connection processing success is computed by breaking the average of the variation of the circuit quality value at the time of a connection processing success memorized as a study value by the average of the variation of the circuit quality value calculated as a description value this time. However, this possibility shall not exceed 100%.

[0177]

[Equation 2]

$$\text{接続処理成功の可能性} = \frac{\text{接続成功時の回線品質値の変動値の平均の学習値}}{\text{今回求めた回線品質値の変動値の平均}}$$

[0178] Next, the duration of connection processing is predicted based on the following several 3 (S33).

[0179]

[Equation 3]

$$\text{接続処理の所要時間} = \frac{\text{接続処理成功時の接続処理所要時間の学習値}}{\text{接続処理成功可能性}}$$

[0180] Furthermore, the time amount in which a continuation transfer of data is possible is predicted based on the following several 4 (S34).

[0181]

[Equation 4]

$$\text{連続転送可能時間} = \text{データ転送失敗時の連続転送時間} \times \frac{\text{通信失敗時の境界値を下回っている回数の学習値}}{\text{境界値を下回っている回数} + 1}$$

[0182] Moreover, the duration of data transfer is predicted based on the following several 5 (S35).

[0183]

[Equation 5]

$$\text{転送所要時間} = \frac{\text{転送データのサイズ}}{\text{通信速度}}$$

[0184] Moreover, the success percentage of data communication is predicted based on the following several 6 (S36).

[0185]

[Equation 6]

$$\text{データ通信の成功率} = \frac{\text{回線品質値の変動の平均} - \text{データ転送失敗時の回線品質値の変動の平均の学習値}}{\text{データ接続処理成功時の回線品質値の変動の平均の学習値} - \text{データ転送失敗時の回線品質値の変動の平均の学習値}}$$

[0186] With the above procedure, the various forecasts about the quality of data communication can be calculated. The calculated forecast is sent to a display 110 and displayed in the intelligible condition to a user.

[0187] The example of a display of the calculated forecast is explained based on drawing 23 (a) thru/or (c). Here, a radio communication equipment 100 explains the example which it is constituted as the cordless handset of PHS, and hardware of one, and was constituted with the liquid crystal display 901 in which the display 110 was contained by the above-mentioned cordless handset, as shown in this drawing (b) thru/or (c).

[0188] As shown in this drawing (a) and (b), the above-mentioned cordless handset is equipped with the dialing key 902 and the actuation key 903 for a user to perform various kinds of operator guidance like the usual telephone. By

operating the actuation key 903, a user can perform directions of the actuation about data communication to a radio communication equipment 100.

[0189] This drawing (c) expands and shows the example of a display of the above-mentioned liquid crystal display 901. Here, on the liquid crystal display 901, field strength, the possibility of a connection processing success, and the success percentage of data communication are displayed in a rod-like graph, respectively, and are numerically displayed respectively under the graph of the shape of an above rod about the selectable maximum transmission speed, the duration of connection processing, and the duration of data transfer.

[0190] Moreover, a display is the example performed with LED904 and a liquid crystal display 901, and when it is beyond a fixed value with each forecast of field strength, the possibility of a connection processing success, and the success percentage of data communication, it consists of cordless handsets shown in this drawing (b) so that LED904 may be turned on. About the selectable maximum transmission speed, the duration of connection processing, and the duration of data transfer, when a user operates the actuation key 903, as shown in this drawing (c), it is numerically displayed on a liquid crystal display 901. Moreover, a user can choose whether every communications partner is predicted by actuation of the actuation key 903.

[0191] As mentioned above, the radio communication equipment 100 in the

gestalt 1 of this operation measures quality of a wireless circuit with a predetermined time interval, and accumulates the measured circuit quality value in the circuit quality storage section 107 serially. And in case quality of data communication is predicted, it is the configuration which takes out the circuit quality value of N individual accumulated by the event of performing the prediction from the event of there being the past from the circuit quality storage section 107, extracts the description of these circuit quality values, and predicts quality of data communication based on the extracted description.

[0192] That is, the dependability of a prediction result can be conventionally raised by performing like before, prediction based on the situation of the circuit quality continued, measured and accumulated from the event of there being the past rather than predicting only based on the circuit quality of a certain flash.

[0193] Moreover, the above-mentioned radio communication equipment 100 has the study value which makes into the criteria for predicting quality of data communication, and when the predetermined event defined beforehand, such as a success / failure in connection processing with a phase hand, or failure in data-transfer processing, occurs, the description of the circuit quality value accumulated extracts, and make the description value extracted reflect and the above-mentioned study value updates like the above. Moreover, according to the conditions of data communication, two or more kinds of this study value are

prepared, and since it is constituted so that the study value according to data communication conditions when that event occurs may be updated, the activation situation of the past data communication is reflected suitable for a study value. This becomes possible to perform suitable prediction according to a situation, and the effectiveness that a radio communication equipment with a user able to grasp the situation of data communication more exactly can be offered is done so.

[0194] [Gestalt 2 of operation] It will be as follows if other gestalten which operation of this invention requires are explained.

[0195] The gestalt of this operation explains the configuration for performing bearer data communication using PHS.

[0196] Since actuation unlike the case where the deemed voice by modem which was explained with the above-mentioned gestalt 1 of operation in the case of the bearer data communication using PHS is used return received data to voice once and change into data with a modem further becomes unnecessary, the voice codec section 105 shown in drawing 1 in the gestalt 1 of operation becomes unnecessary, and the configuration of the data-communication modem section 111 also differs from the aforementioned configuration.

[0197] The case where only existing on a public line transmits data to the modem for nothing voice through Public PHS is explained below. The bearer

data sent from PHS telephone lead to the facility called the modem pool which changes bearer data into the data for deemed voice modems via the base station of PHS, the exchange, and ISDN, and are changed into the data for voice modems here. Then, it becomes the form sent to the modem of the partner on a public line.

[0198] When transmitting bearer data to a public (premises) network through the premises PHS of Public PHS, the bearer data sent from PHS telephone are changed and transmitted to the data format suitable for the classes (for example, X.25, ISDN, etc.) of network which let the base station and the exchange of PHS pass, and has been connected. Then, it connects with the host computer of the partner on a network etc.

[0199] Also in the wireless circuit by which bearer data which were described above are transmitted and received As a circuit quality value as the gestalt 1 of operation explained, it acts as the monitor of the eye pattern of (a) recovery signal. The approach of searching for the error of a recovery signal, the approach of measuring the rate of a framing error of the (b) control channel, (c) It is possible to use the approach of measuring the bit error rate of a control channel and the four approaches of approach ** which measure (d) field strength, and data communication quality as well as the gestalt 1 of the aforementioned operation can be predicted.

[0200] [Gestalt 3 of operation] It will be as follows if other configurations are explained to the pan concerning the gestalt of operation of this invention.

[0201] Here, the case where bearer data communication which used the cellular phone of a digital cellular communication system is performed is explained. The bearer data transmission services using the cellular phone of a digital cellular communication system The bearer data with which only existing on the same digital cellular phone and a dial-up line assumes transmitting data to the modem for nothing voice, and is sent from a portable telephone as a communications partner It lets a base station and the exchange pass, and when a communications partner is on a public line, after being sent to the facility called the modem pool which changes bearer data into the data for deemed voice modems and being changed into the format for voice modems, it becomes the form sent to the modem of a communications partner.

[0202] In the case of the bearer data communication using the cellular phone of a digital method, the data strange recovery method in wireless poses a problem. Like PHS illustrated with the gestalt 1 of operation, when the rectangular cross strange recovery method is adopted As an approach of measuring the quality of a wireless circuit, like the configuration of the gestalt 1 of operation (a) It acts as the monitor of the eye pattern of a recovery signal, and all of the approach of searching for the error of a recovery signal, the approach of measuring the rate

of a framing error of the (b) control channel, the approach of measuring the bit error rate of the (c) control channel, and four kinds of approaches of approach ** that measure (d) field strength can apply. Moreover, when a data strange recovery method is except a rectangular cross strange recovery method, the approach of of the above-mentioned (b) thru/or (d) can be applied.

[0203] Moreover, in the approach of of (b) and (c), a format of the control channel in a digital cellular phone can be used.

[0204] That is, it is possible like the gestalt 1 of said operation to predict quality of data communication by calculating a study value using the circuit quality value which that from which the measuring method of the quality of a wireless circuit may differ the configuration of the gestalt 1 of said operation and a little measured in the radio communication equipment using the wireless circuit in which bearer data communication using the cellular phone of a digital cellular communication system is performed.

[0205] [Gestalt 4 of operation] It will be as follows if other configurations are explained to the pan concerning the gestalt of operation of this invention.

[0206] Here, the case where change data into deemed voice and it communicates with a modem using the cellular phone of an analog form is explained. When the cellular phone of an analog form is used, the activity gestalt is the same as that of the configuration using PHS of the above mentioned

gestalt 1 of operation, it is regarded as a partner's modem through a public line, and data communication with voice is performed.

[0207] However, since a strange recovery method differs from PHS when using the cellular phone of an analog form, Four kinds of approaches of measuring the quality of the wireless circuit explained with the gestalt 1 of said operation, Namely, the method of acting as the monitor of the eye pattern of (a) recovery signal, and searching for the error of a recovery signal, (b) The approach of (a) cannot be used among the approach of measuring the rate of a framing error of a control channel, the approach of measuring the bit error rate of the (c) control channel, and approach [ of measuring (d) field strength ] **. However, it is possible to measure the quality of a wireless circuit using the approach of of (b) thru/or (d).

[0208] (b) And about the approach of (c), a format of the control channel in the cellular phone of an analog form can be used.

[0209]

[Effect of the Invention] As mentioned above, the radio communication equipment of this invention according to claim 1 A measurement means to measure wireless circuit quality, and a circuit quality storage means to accumulate serially the measured value of the wireless circuit quality acquired by the above-mentioned measurement means, It is the configuration equipped with

a communication link quality prediction means to predict the quality of data communication based on the measured value of the wireless circuit quality accumulated in the above-mentioned circuit quality storage means from the event of there being the past at a fixed period, and an information means to report to a user the result predicted by the above-mentioned communication link quality prediction means.

[0210] Thereby, a user becomes possible [ taking the measures of postponing activation of data communication ] until it can check the possibility of a success of data communication with an information means, and it moves in a situation better when the possibility of a success is low the activation front of data communication, and during activation in the location which can communicate or a situation is improved. Moreover, since the above-mentioned prediction is what is obtained from the are recording result of the measured value in a predetermined period, it has high dependability as compared with the prediction based on the measured value of only a certain flash. Consequently, the situation of a wireless circuit of tending to change circuit quality can be grasped exactly, and the effectiveness that the radio communication equipment which can predict quality of data communication effectively can be offered is done so.

[0211] A radio communication equipment according to claim 2 is the configuration further equipped with an error measurement means measure the

error which changes the regular point of the above-mentioned recovery signal into a zero, and produces to a recovery signal by the noise as a distance from the above-mentioned zero in the two-dimensional space centering on the amplitude direction of a recovery means get over to the recovery signal which has the inphase component and the quadrature component which intersect perpendicularly mutually the subcarrier which received from the wireless circuit, and the above-mentioned inphase component and a quadrature component.

[0212] This is enabled to observe only the error by the noise, without spoiling the property of a noise, and the property of a noise can be measured easily. Consequently, the situation of a wireless circuit of tending to change circuit quality can be grasped more exactly, and the effectiveness that the radio communication equipment which can predict quality of data communication effectively can be offered is done so.

[0213] [ when a study value storage means to memorize the study value made into criteria for a radio communication equipment according to claim 3 to predict the quality of data communication, and the predetermined event about data communication occurred ] While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time The study value which is calculated based on the above-mentioned predetermined event in the past, and has already been

memorized by the above-mentioned study value storage means [ when it has a study value decision means to update to the new study value in which the above-mentioned description was made to reflect and the above-mentioned communication link quality prediction means predicts the quality of data communication ] It is the configuration which predicts the quality of data communication by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing the study value memorized by this description and the above-mentioned study value storage means.

[0214] When the study value made into the criteria for predicting the quality of data communication by this is always updated by the study according to the situation of a wireless circuit, the dependability of prediction of data communication is raised further. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and the effectiveness that the radio communication equipment which can ensure prediction of the quality of data communication can be offered is done so.

[0215] A radio communication equipment according to claim 4 includes termination of connection processing with the partner of data communication as the above-mentioned predetermined event. The above-mentioned study value storage means memorizes at least one side of the study value corresponding to

each at the time of [ which connection processing terminated normally ] case and terminating abnormally. The above-mentioned study value decision means by searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period before the event of connection processing being completed whenever connection processing was completed, and making this description reflect [ while updating the study value memorized, when the above-mentioned communication link quality prediction means predicts the quality of data communication ] It is the configuration which predicts the situation of connection processing with the partner of data communication by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing this description with the above-mentioned study value.

[0216] The description of the circuit quality value accumulated by this whenever connection processing with the partner of data communication terminates normally or terminates abnormally is made to reflect, and a study value is updated. That is, at least in one side with the case where it terminates abnormally with the case where connection processing terminates normally, possibility that the connection processing performed from now on will be successful can be more certainly predicted by updating a study value. Moreover, the circuit quality at the time of a success or failure in connection processing

taking place can be used still more effectively as a decision ingredient of a subsequent forecast by establishing a separate study value according to each case at the time of [ which connection processing terminated normally ] case or terminating abnormally, and updating, respectively. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and the effectiveness of becoming possible to offer the radio communication equipment whose soundness of prediction of the quality of data communication improved is done so.

[0217] A radio communication equipment according to claim 5 is further equipped with a transfer means to choose either from two or more kinds of transfer rates, and to perform data communication. [ when the above-mentioned study value storage means was equipped with the storage region which memorizes the study value according to each of the transfer rate which can be set up with the above-mentioned transfer means, respectively and the predetermined event concerning / the above-mentioned study value decision means / data communication occurred ] While updating the study value of the storage region according to the transfer rate which searched for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time, and it is at the event and the transfer means has chosen [ above-mentioned ] to the new study value in which the

above-mentioned description was made to reflect [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] The above-mentioned transfer means is the configuration which predicts a selectable transfer rate by searching for the description of the circuit quality value accumulated in a fixed period of before at that time, and comparing the study value memorized by this description and the above-mentioned study value storage means.

[0218] That is, since it is always updated by reflecting the description in which the study value used as the criteria which choose a transfer rate is extracted from the circuit quality value based on the circuit quality value of a certain flash by which is not a thing and fixed period are recording was carried out, selection of a transfer rate will be performed more appropriately. Consequently, even if it uses the wireless circuit in which it tends to change circuit quality, the effectiveness of becoming possible to offer the radio communication equipment which can predict the quality of data communication appropriately is done so.

[0219] the time check which measures a duration after a radio communication equipment according to claim 6 starts connection processing until it ends -- with a means A study value storage means to memorize the description of the circuit quality value accumulated in the duration of the connection processing in the past, and a fixed period before this connection processing as a study value,

While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time whenever connection processing is completed It has a study value decision means to update to the new study value in which the duration measured with the means was made to reflect. the study value already memorized by the study value storage means -- the above-mentioned description and a time check -- [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] It is the configuration which predicts the duration of connection processing as quality of data communication based on the study value which searches for the description of the circuit quality value accumulated in a fixed period of before at that time, and is memorized by this description and the above-mentioned study value storage means.

[0220] According to the description of the circuit quality value accumulated the duration of connection processing whenever data communication is performed, and then by this, a study value is always updated. That is, since the study value used as the criteria which predict the duration of connection processing as quality of data communication is always updated according to the situation, the dependability of the duration predicted can be raised further. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and the effectiveness that the radio communication equipment which

can predict quality of data communication effectively can be offered is done so.

[0221] the time check which measures a duration after a radio communication equipment according to claim 7 starts data communication until it ends -- with a means A study value storage means to memorize the description of the circuit quality value accumulated in the duration of the data communication in the past, and a fixed period before this data communication, While searching for the description of the circuit quality value accumulated in the circuit quality storage means at a fixed period of before at that time whenever data communication is completed It has a study value decision means to update to the new study value in which the duration measured with the means was made to reflect. the study value already memorized by the study value storage means -- the above-mentioned description and a time check -- [ when the above-mentioned communication link quality prediction means predicts the quality of data communication ] It is the configuration which predicts the time amount in which the continuation communication link of data is possible as quality of data communication based on the study value which searches for the description of the circuit quality value accumulated in a fixed period of before at that time, and is memorized by this description and the above-mentioned study value storage means.

[0222] a duration whenever it performs data communication, after starting data

communication by this until it terminates normally or terminates abnormally -- a time check -- it is measured by the means and the duration of the measured data communication is memorized as a study value with the description extracted from the circuit quality value accumulated in a fixed period before this data communication. Furthermore, based on this description and a study value, the time amount in which the continuation communication link of data is possible is predicted. Moreover, since the above-mentioned study value is always updated according to the situation whenever data communication is performed, it can raise the dependability of a forecast further. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and the effectiveness that the radio communication equipment which can predict quality of data communication effectively can be offered is done so.

[0223] A radio communication equipment according to claim 8 is equipped with a communication link activation means to choose and perform either from two or more kinds of data communication applications. When the above-mentioned study value storage means is equipped with the storage region which memorizes the study value according to each of selectable data communication application with the above-mentioned communication link activation means and the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurs While updating the study value memorized

in the storage region according to the data communication application which the communication link activation means has chosen When the above-mentioned communication link quality prediction means predicts the quality of data communication, it is the configuration which predicts using the study value memorized in the storage region according to the data communication application which the communication link activation means has chosen.

[0224] When the study value according to each of the data communication application which can be performed is memorized to each field of a study value storage means and predicts the quality of data communication by this, prediction of the quality of data communication is performed based on the study value according to the data communication application which the communication link activation means has chosen. Moreover, since the thing according to the data communication application chosen at the event is updated when the predetermined event about data communication occurs, the above-mentioned study value becomes possible [ predicting the situation of data communication more exactly according to the class of data communication application ]. Moreover, since the study value according to each data communication application is always updated when this application is performed, it can raise the dependability of prediction further. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and the

effectiveness of becoming possible to offer the radio communication equipment which can predict quality of data communication effectively is done so.

[0225] A radio communication equipment according to claim 9 is equipped with two or more kinds of storage regions where the above-mentioned study value storage means memorizes the study value according to the magnitude of commo data. While updating the study value of the storage region corresponding to the magnitude of the commo data at the time of the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurring When the above-mentioned communication link quality prediction means predicts the quality of data communication, it is the configuration which predicts using the study value of the storage region according to the magnitude of commo data.

[0226] When prediction of the quality of data communication is performed and the predetermined event about data communication occurs by this based on the study value according to the magnitude of commo data, the study value according to the magnitude of the commo data set as the communicative object at the event is updated. Consequently, it becomes possible to predict the situation of data communication more exactly according to the magnitude of data, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and the effectiveness that the radio communication equipment

which can predict quality of data communication still more effectively can be offered is done so.

[0227] A radio communication equipment according to claim 10 is equipped with two or more kinds of storage regions where the above-mentioned study value storage means memorizes a study value according to the identifier of the partner of data communication. While updating the study value of the storage region corresponding to the identifier of the communications partner at the time of the predetermined event concerning [ the above-mentioned study value decision means ] data communication occurring It is the configuration that the above-mentioned communication link quality prediction means predicts using the study value of the storage region according to the identifier of the communications partner at the time of predicting the quality of data communication.

[0228] When the study value for every identifier of the partner of data communication is memorized to each field of a study value storage means and predicts the quality of data communication by this, the quality of data communication is predicted based on the study value according to the identifier of the phase hand who is going to perform data communication. Furthermore, when the predetermined event about data communication occurs, the study value about the communications partner at the event is updated. Consequently,

it becomes possible to predict the situation of data communication more exactly according to a communications partner. Consequently, the situation of a wireless circuit of tending to change circuit quality is grasped more exactly, and the effectiveness of becoming possible to offer the radio communication equipment which can predict quality of data communication effectively is done so.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the outline configuration of the radio communication equipment as one gestalt concerning operation of this invention.

[Drawing 2] It is the block diagram showing the relation between the data communication application activation section with which the above-mentioned radio communication equipment is equipped, and the block relevant to it.

[Drawing 3] This drawing (a) is an explanatory view showing an example of the hardware configuration of the above-mentioned radio communication equipment, and this drawing (b) is an explanatory view showing an example of the display screen which shows a user a prediction result.

[Drawing 4] This drawing (a) is an explanatory view showing other examples of

the hardware configuration of the above-mentioned radio communication equipment, and this drawing (b) is an explanatory view showing other examples of the display screen which shows a user a prediction result.

[Drawing 5] This drawing (a) is an explanatory view showing the example of further others of the hardware configuration of the above-mentioned radio communication equipment, and this drawing (b) is an explanatory view showing the example of further others of the display screen which shows a user a prediction result.

[Drawing 6] It is the explanatory view showing the regular location of the eye pattern of the recovery signal in a certain time of day, and the error included in the above-mentioned recovery signal.

[Drawing 7] It is the block diagram showing the configuration of the circuit for observing an eye pattern.

[Drawing 8] It is the circuit diagram showing the configuration of a reference-value generator.

[Drawing 9] It is the explanatory view showing the eye pattern in pi / 4 shift QPSK method adopted with PHS.

[Drawing 10] The eye pattern and this drawing (c) where the eye pattern and this drawing (b) where this drawing (a) is observed when white noise is included in a recovery signal are observed when white noise and a phase jitter are contained

in a recovery signal are an explanatory view showing the eye pattern observed when white noise and an amplitude jitter are contained in a recovery signal, respectively.

[Drawing 11] It is the explanatory view showing the measuring method of the error included in a recovery signal.

[Drawing 12] It is the block diagram showing the configuration of a circuit quality test section in the case of measuring the rate of a framing error as a circuit quality value, and relation with other blocks.

[Drawing 13] This drawing (a) and (e) are the explanatory views used as the object which measures a circuit quality value in which getting down and showing an example of a control slot, respectively, and this drawing (b) thru/or (d) are the explanatory views showing an example of the control channel used as the object which measures a circuit quality value, respectively.

[Drawing 14] It is the block diagram showing the configuration of a circuit quality test section in the case of measuring a bit error rate as a circuit quality value, and relation with other blocks.

[Drawing 15] It is the explanatory view showing the configuration of the circuit quality storage section, and relation with other blocks.

[Drawing 16] It is the explanatory view showing the various description example values extracted from the circuit quality value of N individual memorized by the

circuit quality storage section.

[Drawing 17] In the above-mentioned radio communication equipment, it is the explanatory view showing the main blocks which update a study value, and the main data exchanged among these blocks.

[Drawing 18] It is the flow chart which shows the procedure of an update process of a study value.

[Drawing 19] It is the flow chart which shows the detail of the processing of S5 in the flow chart shown in drawing 18 .

[Drawing 20] It is the flow chart which shows the detail of the processing of S6 in the flow chart shown in drawing 18 .

[Drawing 21] It is the flow chart which shows the detail of the processing of S10 in the flow chart shown in drawing 18 .

[Drawing 22] In the above-mentioned radio communication equipment, it is the explanatory view showing the main blocks which process prediction of data communication quality, and the main data exchanged among these blocks.

[Drawing 23] It is the flow chart which shows the procedure of prediction processing of data communication quality.

[Drawing 24] This drawing (a) and (b) are the explanatory views showing roughly the appearance of the hardware configuration at the time of collecting each block shown in drawing 1 to the cordless handset of PHS, and this drawing (c) is an

explanatory view showing an example of the display screen of the display with which the above-mentioned hardware configuration is equipped.

[Drawing 25] This drawing (a) and (b) are the block diagrams showing the example of a configuration of the conventional eye pattern monitor, respectively.

[Description of Notations]

106 Circuit Quality Test Section (Measurement Means)

107 Circuit Quality Storage Section (Circuit Quality Storage Means)

108 Data Communication Quality Prediction Section (Communication Link Quality Prediction Means)

110 Display (Information Means)

109 Data Communication Quality Study Section (Study Value Decision Means)

645 Study Value Storage Section (Study Value Storage Means)